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COMMUNICATION IN PRE-SCHOOL CHILDREN

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Ph.D.

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DECLARATION

I declare that this thesis has been composed by myself and that the work reported in it is my own.

No part has been submitted in support of an application for another degree or qualification of this or any other University or institute of learning.

Signed:

Peter Lloyd

Summary

Piagetian theory and previous research suggest that the child below school age is severely handicapped in his verbal communication by egocentrism. This is said to be revealed by a speaker's inability to perceive the listener's role attributes. Investigations of the communicative abilities of children between three and five years were still considered feasible and some of Piaget's own findings and those of others are cited in justification. In particular, tasks should be within the known ability range of young children and should take advantage of a child's preference for active participation in a concrete situation.

Recent theories of semantic development emphasising the importance of context were believed to be relevant to the proposed research which had six main aims: (1) To assess the communication abilities of pre-school children in a discrimination task. (2) To determine the types of strategies used, successful or otherwise, in the roles of speaker and listener. (3) To break down the communication process into its constituent skills and to discover the ability level of children engaged in tasks designed to measure these skills. (4) To test one aspect of the egocentric hypothesis by providing the child with a partner whom he would recognise as inferior in knowledge and ability (a talking doll). (5) To establish some parameters of the effects of context or extra-linguistic factors (e.g. type of material) on speech production and comprehension. (6) To develop a technique for investigating thinking in the young child by having one child instruct another in a conceptual problem.

The sample was confined to 30 children in all, attending a research nursery. This allowed the long term development and establishment of effective methods and the use of techniques such as a talking doll. Extensive use was made of videotape equipment in preparing experimental

procedures and assessing performance. A necessary consequence of the sampling conditions was that a full measure of control was not always possible. The basic task had two participants, facing each other across a table, one acting as speaker and the other as listener. Each player had the same collection of objects (screened from the other's view) which differed on certain features within sets. The speaker's task was to describe the objects one by one so that the listener could identify them from his set in the order reported. Experiments were conducted with a child communicating with a peer, an adult and a talking doll. Tasks varied along a dimension of concreteness of differentiating features and the number of alternatives from which the specified item had to be discriminated. In relation to the aims outlined the findings were as follows: (1) As communicators pre-school children were some way short of competence but considerably more accomplished than previous theory and findings predicted. A significant proportion of children were consistently able to produce messages sufficiently adequate to specify an intended referent. Effectiveness declined with more abstract material and was significantly correlated with the number of alternatives available. The improvement on previous findings was thought to be due to the use of more sensitive measures of communication ability and to more representative tasks. (2) Qualitative analysis revealed that differentiating features tended to be reported first and that irrelevant information dropped away with age but number of features reported did not correspond to an ideal strategy. Listeners were seen to be a major cause of communication failure by not providing feedback and by acting independently in an unproductive fashion. (3) Two skills involved in these tasks were perceptions of differentiating features and conservation of amount and identity. The latter was shown to be absent under certain conditions while judgements of differences tended to be governed by the saliency of features for individual subjects. Some relevant findings

were reported in the area of conservation of number and acquisition of relational terms. Paired with an adult listener providing feedback, children as speakers showed they were far from egocentric in modifying messages. Paired with an adult speaker providing minimally adequate (non-redundant) messages children achieved a high level of discrimination success. (4) The findings indicated that an absolutist position on egocentrism must be rejected. It was better to consider it as a long term developmental phenomenon involving limitations of perception, cognition and language, rather than as a unitary construct confined to one age period. Attentional factors were thought to be especially important for the listeners failures who were seen as the main cause of communication breakdown. (5) Many specific effects of context on communication were reported. It seemed that there were two broad aspects. One was related to the properties of materials which captured attention and therefore affected object choice and the features reported by speakers; it also contributed to comprehension difficulties when listeners relied on non-linguistic strategies for determining the meaning of utterances. The second was the effect of context as a whole on the construction of messages and showed that even young children take account of the intended referent in relation to the perceived alternatives. (6) Children made good instructors in a conceptual problem as long as the task material did not require the use of abstract instructions. When the task became demanding, speech tended to dry up, with obvious consequences for the listener. The advantage of this technique for investigating thinking was that the child was encouraged to make explicit the strategies used in solving problems. It was suggested that tasks providing an even more active role for the players, and making the perceived goal more explicit, would represent a valuable follow-up to this work.

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Chapter 1. Introduction

"When I use a word," Humpty Dumpty said in a rather scornful tone,
 "it means just what I choose it to mean - neither more nor less."

(Lewis Carroll, *Through the Looking Glass*, 1871)

"I know what I meant to say".

(Richard M. Nixon, U.S. Television Broadcast, April 30, 1974)

If we all possessed the supreme egotism of Humpty Dumpty, it is doubtful if language would survive long. Although Humpty prided himself on lucid speech, because he chose words to mean what he wanted them to mean, without taking account of others, he was essentially in a verbal vacuum - a talking machine unable or unwilling to adapt to the demands or conventions of the remainder of the speaking community. Some have likened the young child to Humpty Dumpty in this respect, but before embarking on that issue, it is worth considering for a moment what is normally regarded as the day to day use of language.

Language has been called a species specific behaviour of man. (Lemneberg, 1969). and the prime function of language is communication. Unfortunately language is not the perfect tool for this purpose, and although it is frequently assisted by gestures, facial expressions and the like, as well as the prosodic features like tone and stress, there remains a large margin for error in transmission of information from one individual to another. There is, for example, the situation expressed in the second quotation above, of having one's meaning construed in a different manner from that intended or claimed. Leaving aside the particular case, a failure to communicate adequately is a regular occurrence for most of us. The consequences may vary from bafflement, annoyance or possibly amusement, to the downright disastrous.

And yet we manage fairly well with this imperfect instrument. One of the reasons we do, is that apart from the aids to communication mentioned above, there are two other important contributions. If the discussion is confined to spoken communication, these are (i) the fact that dialogue takes place in a context, a reality, and this context will very often help to determine the nature of speech when simple reliance on the verbal utterance may give rise to confusion, and (ii) that communication is a dynamic process involving at least two participants. If we take the reality component first, this practically always plays some part. When someone says 'There's nothing I like more than a good novel', as he puts down a book by Mickey Spillane, we are able to conclude something about that person's taste in literature. The remark may have been made sarcastically, of course, but discounting any evidence to the contrary, we would normally assume such a sentence to refer, in good faith, to the book that had been put down. A statement like, 'Can I have another one?' might give rise to a great deal of difficulty without the situation to aid interpretation. If the speaker was holding out an empty glass then one would infer that he wanted another drink. If, however, one was an attendant in a Turkish Bath and the speaker was a particularly large man, one might think he was asking for a second towel.

An even more valuable means of determining the meaning of a spoken utterance, should there be any doubt, is to ask for an expansion. Most everyday discourse has people playing two simultaneous roles, those of speaker and listener. Frequently the speaker will invite a reply from his listener and he will certainly expect, unless a tyrant, to be asked to say what he means if the listener is not clear about something. Thus the response to 'Can I have another one?' might be 'Sweet or dry?', or 'Another what?'. A modification of the original request by the first speaker should then lead to a satisfactory outcome for that small episode of dialogue.

Underlying all this behaviour is the foundation on which we assume it is built. This is that communication is purposive. When someone says something to us we assume he has something to say. Even if what he says is a substitute for something else, as in the euphemistic cliché, 'Would you like to come and see my etchings?', or a device for keeping the conversation going like 'Did you really?', we nevertheless recognise, or unconsciously assume, some intent. At the last resort, when all other appendages to the communication process have failed to enlighten us, we will continue to try to discover what the speaker means because we believe he would not be talking to us if there was not something that he wished us to know.

Now although the above sketch of the communication process may require assumptions concerning man as a rational being which are not justified, the outline does not violate reality unduly. But where it might be said to present an unrealistic picture would be if applied to the language behaviour of young children. This is basically because many of the elements which enable the social purpose of language to function reasonably smoothly are acquired skills. And here one is not referring, primarily, to the command of language itself but to the associated factors which, it has been argued, make verbal understanding between people possible. It will be the purpose of the research to be reported to define as precisely as possible what these factors are, some of which have already been described in very broad terms. Having defined them, the hope will be to investigate their existence, genesis and utility in children between three and five years of age.

Before continuing in this endeavour, a word should be said about the wider rationale behind these studies. The facility of being able to transmit perceptions, thoughts and feelings to our fellow men is something we usually take for granted. Yet when we encounter those who are unable to enjoy this natural human ability, because of some physical or mental

impairment, we realise what a profound loss they suffer. Granted we have the ability, it is important that we understand it and make it our valuable servant, for though it may seem hackneyed to say so, it is nevertheless the case that a great many of our ills are due to failures of communication. They may be on the grand scale as when nations seem unable to agree on apparently simple goals, or they may be as trivial as not understanding the instructions for opening a tin of sardines. The area of particular interest is education. Communication is often coupled with education as the twin panaceas which will, given time, solve our social problems. As slogans they are harmful, because they can become a substitute for action. But if we can discover better methods for promoting understanding, for nurturing the desire for knowledge which someone has said is also species specific to us (Piaget 1971), then the smallest contribution is worth while.

A difficulty in providing background to the research being undertaken, is that there is little empirical work and even less theory which can be directly related to it. Pre-school children have not been considered a productive group in which to investigate communication. Nevertheless the tradition from which it arises can be seen more clearly. Piaget's pioneer work in the 1920's is first reviewed because it has had a considerable influence, not all of it desirable, on the direction research has taken. Vygotsky is another figure who has had an impact on the field and the implications of the work of both Piaget and Vygotsky will be made explicit. Flavell, together with a group of co-workers, has developed a model of communication behaviour derived from Piaget, Vygotsky and Mead. This, as well as some empirical work by his team, will be considered. The other major series of existing studies are those by Krauss and Glucksberg; these are also assessed. On the basis of this

evidence, and that from certain other sources, justifications for the research to be presented will be given. It is also necessary to give some indication of the theoretical bias governing the research, in particular in the area of meaning, which is intimately related to communication.

There will be no mention here, however, of communication theory, the branch of psychology which has sought to provide a formal mathematical account of the transmission of information. It will become evident that the extent of the empirical knowledge is as yet insufficient to justify such an approach. Nor is the work on communication networks, begun by Bales (1950), appropriate to these studies. The model developed by MacLay and Newman (1960), derived from communication studies with adults, may be applied to children's behaviour with profit, but the approach taken here has been a different one. (see Chapter 2).

Much of the interest in the role of language in the young child's cognitive development has been stimulated by Piaget's early work, 'The Language and Thought of the Child', originally published in 1923 and in English in 1926 (3rd edition, 1959). Somewhat ironically Piaget has since become noted as an exponent of the minimal part played by language in the development of thought. Nevertheless it is important to begin with a consideration of this pioneer work, since it has strongly influenced subsequent research in this field.

The work has been much criticised, particularly by research workers in the inter-war period who failed to find the volume of egocentric speech in children's spontaneous conversations which Piaget had reported. Egocentric speech is defined as speech where the child "does not bother to know to whom he is speaking nor whether he is being listened to" (Piaget, 1959, p. 9). In contrast to the normal communicative form, socialised speech, egocentric speech is language which does not take account of

the listener. Piaget claimed that even for six year olds it made up 40 per cent of spontaneous language recorded. McCarthy (1954) reviewed the studies which followed up those of Piaget and the general conclusion was that egocentric speech was very much less prevalent than Piaget had indicated. Piaget answered his critics and published fresh data in an additional chapter to 'The Language and Thought of the Child' (1959). His conclusions were as follows:

"starting from its initial stage, during which it no doubt exceeds three-quarters of total speech (without, however, at any time coinciding with speech as a whole), egocentric speech, between the ages of three to six, passes through a semi-stationary phase during which it gradually decreases while at the same time it fluctuates between half and one-third of the total amount of speech; after the age of 7, egocentric speech tends to decrease to less than one-quarter of the totality of spontaneous speech." (Piaget, 1959, p. 257).

These proportions are important since egocentric speech is equivalent to non-communicating speech. But if half is non-socialised, what about the other half? The other half is made up of two categories, dialogues and questions. Dialogues include discussions, information, criticism, orders and so on. The precise proportions of these categories is difficult to establish from the figures presented by Piaget, but it appears that, from a small sample of 4 children, about 30% of the socialised speech consists of questions, 40% of adapted information and 20% of other dialogue. Of these types the most interesting from the standpoint of this research is that of adapted information. In Piaget's words this is defined in the following way:

"The criterion of adapted information, as opposed to the pseudo-information contained in the collective monologue, is that it is successful. The child actually makes his hearer listen, and contrives to influence him, i.e., to tell him something. This time the child

speaks from the point of view of his audience. The function of language is no longer merely to excite the speaker to action, but actually to communicate his thoughts to other people." (Ibid, p. 19).

Now, such speech accounts for about 20% of all spontaneous speech and ranges from 14% at 3.1 years to 26% at 4.4 years. Although the proportion is relatively small it is not negligible and it is difficult to reconcile with statements Piaget was making as recently as 1966.

"The fact is that the speech of subjects between four and six (observed in situations in which children work, play, and speak freely) is not intended to provide information, ask questions, etc. (that is, it is not socialised language), but consists rather of monologues or 'collective monologues' in the course of which everyone talks to himself without listening to the others (that is, egocentric language)." (Piaget and Inhelder, 1969, p. 120).

When Piaget himself has said that nearly half language is socialised, his subsequent statement, even within the confined context of an introductory textbook, seems a rather serious exaggeration.

A possible explanation of this inconsistency is that the figures above are based on content analyses of spontaneous speech. As the quotation below shows, Piaget later became suspicious of the reliability of such data.

"It is essential not to limit oneself to the spontaneous remarks of children in general - experience shows that interpreting them is not always easy - but, as one of us has already done, to make a thorough analysis of the success a child has in getting another child to do something to another or in discussions among children."

(Piaget and Inhelder, 1969, p. 121)

When he studied children in an experimental situation, where one child had to recount a story just heard to another, or describe the workings of an object like a tap with the aid of a diagram, Piaget's conclusions were:

"In both situations, one sees the systematic difficulty children have in taking the point of view of the other, in making him grasp the desired information, and in modifying his initial comprehension."

(Ibid., 1969, p. 121)

It was the results of these experiments that convinced Piaget of the all-pervasive influence of egocentrism on communication and possibly led him to virtually discount the findings from the spontaneous records. (But perhaps this is being too generous to Piaget since the first quotation from Piaget and Inhelder (1969) above, clearly indicates that they are referring to spontaneous speech).

The cause of communication failure, derived from the experimental work, is said to be egocentrism. In an unusual passage, because environmental influences are stressed, Piaget gives the deeper reasons for egocentrism.

"If children fail to understand one another, it is because they think that they do understand one another. The explainer believes from the start that the reproducer will grasp everything, will almost know beforehand all that should be known, and will interpret every subtlety. Children are perpetually surrounded by adults who not only know much more than they do, but who also do everything in their power to understand them, who even anticipate their thoughts and desires. Children, therefore, whether they work or not, whether they express wishes or feel guilty, are perpetually under the impression that people can read their thoughts, and in extreme cases, can steal their thoughts away. It is obviously owing to this mentality that children do not take the trouble to express themselves clearly, do not even take the trouble to talk, convinced as they are that the other person knows as much or more than they do, and that he will immediately understand what is the matter." (Piaget, 1959, pp. 101 - 102)

This passage suggests, among other things, that if a way could be found

of presenting children with a communication situation in which it is quite clearly the case that the other does not 'know as much, if not more than they do', but on the contrary is demonstrably inferior in this respect, egocentrism might diminish, and communication efficiency improve.

Piaget began his formal studies in children's language with the question, "When children talk together do they understand one another?". After those studies his answer to his own question was:

".. it is only from the age of 7 or 8 that there can be any talk of genuine understanding between children. Till then, the egocentric factors of verbal expression (elliptical style, indeterminate pronouns, etc.) and of understanding itself, as well as the derivative factors (such as lack of order in the accounts given, juxtaposition, etc.) are all too important to allow of any genuine understanding between children." (Ibid., p. 125)

Following such a prognostication from a distinguished scholar it seems difficult to defend a programme of research into communication among pre-school children, especially when the sort of purposeful communication which Piaget says does not exist is the basis of the tasks to be used. The egocentric hypothesis has undoubtedly been persuasive. Researchers looking at communication in children almost always start with a lower age limit of 7 years and cite Piaget in support of this, (e.g. Flavell, Botkin, Fry, Wright, and Jarvis, 1968; Shantz and Wilson, 1972; Rubin, 1973). When younger children have been studied, the findings have been interpreted as supporting the egocentric hypothesis, (e.g. Glucksberg, Krauss and Weisberg, 1966).

What, then, is the justification for the proposed research? Firstly there is Piaget's own finding that there is a proportion of the conversation of even 3 and 4 year olds that can be called adaptive information. For example, this conversation between Hans (3y 8m) and Barbara (4y 1m):

Barbara: I want to make a fire (goes near the stove).

Hans: No, Barbara, you mustn't make a fire because we have central heating.

B: Yes, I will.

H: No, mustn't make a fire because its already warm with the central heating.

and

H: Yesterday, I had to have tea all alone.

B: Why, all alone?

H: Because of you, you weren't there. (Piaget, 1959, p. 247)

If, on average, this type of language accounts for some 20 per cent of children's spontaneous conversation, why should it not be used at length in experimental situations which encourage it? The obvious answer is that Piaget did this and found the children's language "saturated with egocentrism". Piaget's tasks, however, were fairly demanding including recounting twelve-point stories and nine-part explanations of the working of a tap or a syringe. Secondly, therefore, it seemed worth trying a different formal task situation adapted to the capabilities of young children. Apart from the fact that Piaget's tasks were considered too demanding for pre-school subjects, there was a methodological (and theoretical) preference for starting with the simplest situation and increasing the difficulty as necessary.

Thirdly, another aspect of young children's language behaviour, also pointed out by Piaget, gave reason for hope. While considering what he calls "the highest types of conversation between children", collaboration and argument, Piaget distinguishes two different cases - the acted case and the verbal case. The former, as its name implies, is connected with action; the collaboration or argument is said to be accompanied by gestures and hand movements. Piaget goes on to say, "it matters little, therefore, whether the talk is intelligible or not, since the talkers

have the object under their eyes". (Piaget, 1959, p. 77) Piaget's impression is that in acted conversation children of 5 and 6 years understand each other well but in the verbal case, involving abstraction, understanding only comes with the reduction of egocentrism between 7 and 8.

A related classification is that by Olson (1972). He has differentiated two uses of language, one for communication - sentences as descriptions, and one for reflection - sentences as propositions. The first type of use is developmentally prior and is the function which both children and adults ascribe to language in everyday usage. As Olson puts it, in the communication sense "the language is completely transparent to the reality that lies behind it; one focuses on the world through the language", (1972, p. 163). In the second type of language "the focus is on the propositions themselves and their relation to other propositions rather than to the reality specified by the sentences" (p. 163)

A similar distinction has been made by Leushina (cited in Elkonin, 1970). Her dichotomy contrasts 'situational speech' with 'contextual speech'.

" .. situational speech does not fully reflect the content of a thought as expressed in verbal forms. Its content becomes clear to the interlocutor only when he takes into consideration that situation about which the child is narrating, and also when he takes into account gestures, movements, mimicry, intonations, etc. Contextual speech differs in that its content is revealed in the context itself, and thus becomes understandable to the listener, independent of whether or not he takes a given situation into account". (Op. Cit., p. 113).

It is not altogether clear what is meant by "context", but since it is being contrasted with "situation", it presumably refers to the verbal statement itself. It must come close to Piaget's "verbal case" and Olson's "proposition".

Leushina found that situational speech tends to characterise the

language behaviour of pre-school children, but that it may become more contextual depending on the nature of the particular task and the conditions of social interaction. At any event, situational speech is developmentally prior. The progression is summarised by Leushina: "from exclusive domination by situational speech, the child moves towards mastery of contextual speech, the relative weight of which increases, depending on the extent to which the child in his relationship with the surrounding environment moves beyond the framework of direct sensory experience" (p. 114). Apart from relating to the outlined speech categories of Piaget and Olson, Leushina's last reference to moving beyond sensory experience is reminiscent of Piaget's concept of decentration and the transition from slavish reliance on perceptual properties to the use of conceptual knowledge.

This discussion of developmentally related functions of language began as a third reason for believing that communication behaviour in young children was a feasible research topic. The relevance of the distinction made is that the communication tasks envisaged will be able to incorporate the features which are appropriate to the language behaviour of the young. In terms of Piaget's classification, the children will be talking about sets of identical objects 'under their eyes' which should mean that collaboration involving action can be utilised. The same point could be made using the terminology of Olson or Leushina, when words like reality and situation would be substituted. It should not be thought, however, that the aim of the research has shifted from an investigation of spoken language. This remains the target, but it seems to be to the advantage of child and researcher for a method to be used that is in some sense 'natural' for the subject.

A fourth reason for undertaking this line of investigation is owed to the writings of Vygotsky (1962) on the nature of egocentric speech. Vygotsky regarded egocentric speech as the precursor of inner speech, which itself is said to have an important directive function in the child's cognitive strategies. Because all language is thought to arise from a social need, and egocentric speech derives from that, there is in the young child no distinction between speech for others and speech for self. Egocentric speech, for Vygotsky, is a hybrid form with the structure of inner speech

(i.e. telegraphic, predicated) but vocalised as social speech. It is predicted in the sense of omitting sentence subjects and telegraphic in reducing language to a few high information carrying words. In contrast to Piaget, Vygotsky believed that egocentric speech decreased with age only in terms of amount vocalised (i.e. quantity) and, in fact, rose to a peak in terms of quality (e.g. degree of predication) at age 7 before submerging as inner speech.

What are the implications of this view for communication? On the face of it, not very bright, since a child who is not distinguishing between speech for self and speech for others is not going to be a fountain of clarity. This is especially so in view of the predicated and telegraphic nature of egocentric speech. As Vygotsky puts it:

"A single word (in inner speech) is so saturated with sense that many words would be required to explain it in external speech. No wonder egocentric speech is incomprehensible to others ..." (1962, p. 148)

At the same time Vygotsky does give a communicative intent to egocentric speech, something denied by Piaget. But the important insight to emerge from Vygotsky's theory is his assertion that

"egocentric speech is a stage of development preceding inner speech: Both fulfil intellectual functions; their structures are similar; egocentric speech disappears at school age, when inner speech begins to develop. From all this we infer that one changes into the other". (p.132)

He goes on to say:

"If this transformation does take place, then egocentric speech provides the key to the study of inner speech. One advantage of approaching inner speech through egocentric speech is its accessibility to experimentation and observation. It is still vocalised, audible speech, i.e., external in its mode of expression, but at the same time inner speech in function and structure. To study an internal process it is necessary to externalise it experimentally. by connecting it with

some outer activity; only then is objective functional analysis possible. Egocentric speech is, in fact, a natural experiment of this type" (p. 132)

According to Vygotsky, then, egocentric speech only gradually becomes differentiated from socialised speech proper. This latter takes on a truly communicative function as the child comes to appreciate the requirements of a listener. He starts to put in sentence subjects and generally flesh out his conversation with words that are redundant for himself. In modern parlance a recoding operation takes place.

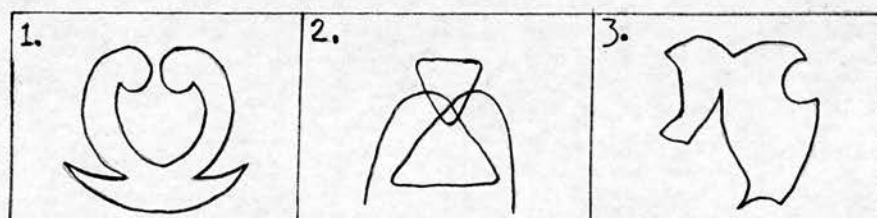
It may be that some evidence of that editing process will be forthcoming in the proposed research since the subjects are between 3 and 5 years. Vygotsky's last quotation above indicates that the experiments envisaged may well provide an opportunity to study egocentric speech, if and when it occurs, as the overt sign of the 'intellectual function'. To quote Vygotsky again,

"egocentric speech ... does not merely accompany the child's activity; it serves mental orientation, conscious understanding; it helps in overcoming difficulties; it is speech for oneself, intimately and usefully connected with the child's thinking." (p. 133). This is not to say that the study of egocentric speech is a major aim of this research. If it were, some of the conditions that Vygotsky himself and Syrkina (reported in Elkonin, 1970) have indicated encourage this form of speech, such as task interruption and working with unfamiliar adults and children, would have been used. Kohlberg, Yaeger, and Hjertholm (1968) have, indeed, carried out a very thorough survey and series of experiments on 'private speech' which have substantially supported Vygotsky. For the present purposes Vygotsky's pertinent and often fascinating pronouncements are noted, and any instances of the phenomenon will be reported.

There is an important series of experiments by Krauss and Glucksberg and various collaborators (1965, 1966, 1967, 1969) which have been partly

instrumental in instigating the present research. They may be said to represent the fifth branch of support for the work. Krauss and Glucksberg have studied communication behaviour in children as young as three years and right up to college student level. Their standard task has consisted of a speaker and listener with identical sets of 6 blocks, with holes through the centre, having novel forms or 'squiggles' drawn on them. The speaker's job is to describe the squiggles so that the listener can stack the blocks, on a peg provided, in the described order. A screen separates the communicators from one another so that they are obliged to rely on verbal messages. A trial is successfully completed when the stacked order of the listener's blocks matches that of the speaker.

In brief the findings were that children below school age were extremely poor at the task, none achieving even a single errorless trial. Communication ability was found to improve with age and go on improving right up to adulthood. For our purposes the performances of the youngest subjects are of particular interest. To gain a better idea of the problems for the pre-school child, it is worth considering the task material. Three of the set of six squiggles are illustrated below.



These forms were used deliberately because they did not lend themselves to simple object names or descriptions - they had 'low codability' to use the research workers jargon. The types of messages sent by the children reflected this. To give some examples, (1) was described variously as 'Mother's hat', 'lion', and 'snake', (2) as 'ghost', 'caterpillar' and 'Mother's dress' and (3) as 'bird', 'dress' and 'knife'. It has been effectively demonstrated that children of nursery age use

idiosyncratic or egocentric speech in such situations - "The imagery employed seemed to be private, rather than socially shared or conventional" (Glucksberg, Krauss, and Weisberg, 1966, p. 338). In support of Vygotsky's thesis it was further found that these idiosyncratic descriptions were completely effective at discriminating forms for the subject who had formulated them when presented at a later date. In other words, when a child is given his own message, 'Mother's hat', he has no difficulty in picking out the correct block.

Although egocentric language seems to be responsible for the failure of these children as communicators, it could be argued that the task material encouraged such behaviour. In a warm-up task the children were given blocks with pictures of familiar animals on them, at which they were generally successful (although one group aged between 33 and 49 months managed no errorless trials with the animals blocks). This seems to indicate that if one wants to investigate the communication ability of small children it helps to use material that is at least within their ken. Certainly, highly abstract material, such as that used by Krauss and Glucksberg, is almost bound to lead to the result they found, though the undoubted interest of their findings as a whole is not in dispute.

A sound procedure would seem to be to start with material which the children are able to describe and which does not stretch their vocabulary, perceptual abilities, etc., unduly, then to increase the demands of the communication effort systematically to discover at what point the procedure breaks down. Glucksberg et al. started with simple enough material, animal pictures, but having established that the method worked they made a considerable jump to material which amounts to Rorschach-like abstractions. Like the reaction to the well-known ink blots, subjects may project any images they happen to see. It is true that older subjects were constrained by the communication situation to describe the forms in terms which had high communality. But, if we wish to gauge

the level of pre-school children's ability in this direction, a necessary precaution is to avoid material encouraging highly imaginative responses.

Another possible criticism of Glucksberg et al.'s procedure, which they refer to themselves, is that the training task (animal pictures) may have given rise to a set to use object names, rather than descriptions, which are then unproductive in the novel forms task. In an attempt to control for this they gave a small group of subjects a modified pre-training task with blocks having two coloured squares on them. Here it was necessary for the speakers to describe both colours for discrimination to be possible. This group of subjects, however, also used object names in the squiggles task. Yet it is somewhat difficult to conceive of any way in which three and four year olds could describe these forms without projecting idiosyncratic object names upon them.

Grushcow and Gauthier (1971) overcame this difficulty by providing ready-made descriptions, for subjects aged between 51 and 62 months, in a communication task adapted from Glucksberg et al. They also controlled for variables which Glucksberg et al. were confounding, familiarity and abstraction; that is, there was a change from familiar objects (animals) to unfamiliar objects (squiggles), and at the same time a change from concrete forms (animals) to abstract forms (squiggles). In order to test whether familiarity or abstractness was the significant variable, Grushcow and Gauthier used material consisting of sets of blocks with familiar and unfamiliar animals upon them, and sets with familiar symbols, capital letters, and unfamiliar symbols, the same letters with their constituent lines rearranged in an unfamiliar pattern. Three-statement descriptions were prepared for each stimulus, an elephant being described as follows: 'His feet are very wide and flat; he has a very long nose which reaches almost to the ground; he has wide floppy ears.'

The children were, of course, only able to perform as listeners in

Grushcow and Gauthier's task, and there was no peer group communication in the fashion originally investigated by Glucksberg et al. The experiment was, in fact, a comparison with a second experiment reported by Glucksberg et al in which children were paired with the experimenter, as speaker, who provided descriptions of the novel forms based on the protocols of adult subjects. In this condition 67% of children were successful. Grushcow and Gauthier's findings were that the difference between animals and symbols was significant but the familiarity variable was not. They conclude that the important factor in Glucksberg et al.'s study was a change from animals to symbols rather than familiarity per se. It is not clear, however, if the abstractness of Grushcow and Gauthier's material, the letters, can be equated with Glucksberg et al's squiggles.

A sixth and final reason why this research is being conducted in apparent defiance of certain negative findings, means returning to Piaget once more. On the basis of his experimentation with 6 - 8 year olds Piaget was satisfied that no comprehensible communication was possible between nursery age children. Although his arguments are persuasive, the fact remains that he has not carried out research of this nature with children under five and so no hard data is available. But, if Piaget is right, it is surely still worth studying the communication endeavours of younger children in a formal situation in order to understand how the process does develop. The ability to understand, and make oneself understood, does not arise suddenly, it is built on something and the sort of skills on which it is based should be investigated. In short, therefore, the questions are: Can children between 3 and 5 take part effectively in meaningful communication tasks? If not, why not? What are the abilities that they lack? Is egocentrism an explanation? Or is this, itself, a global term for a number of distinct perceptual, cognitive and linguistic skills? Even if one takes a pessimistic view, that success in the tasks will be as limited as that achieved by Krauss and Glucksberg's subjects,

there remains the possibly greater value to be derived from an analysis of the performance records - that is, an understanding of what gives rise to failure.

One of the main works in this still largely uncharted area is that by Flavell, Botkin, Fry, Wright and Jarvis (1968). Their model of communication draws on the theories of Piaget, Vygotsky and Mead. It is a model which places considerable emphasis on the ability to take roles. This is defined as follows:

"The basic and essential ingredients of any sort of skill sequence in this area appears to us to be that process in which the individual somehow cognizes, apprehends, grasps - whatever term you prefer - certain attributes of another individual. The attributes in question are primarily of the type that could be described as inferential rather than directly perceptible, for example, the other's needs, his intentions, his opinions and beliefs, and his emotional, perceptual, or intellectual capacities and limitations." (Flavell et al., 1968, p. 5)

The young child is thought to be poor at communication because he fails to take into account the listener's role attributes and the reason for this, after Piaget, is his egocentrism. Coupled with this is the notion, noted by Piaget but most forcefully expressed by Vygotsky, that the young speaker does not distinguish his private or egocentric speech from his public or social speech. The necessary editing or recoding, which later goes on, to make an observation fit for someone else's consumption does not occur at this earlier age.

It may be that Flavell et al. over-emphasise the part played by failure to take roles, to the neglect of other perceptual, cognitive and linguistic factors involved in communication. This is not to say they are not given a place in the model but that they are not seriously

explored like the other area. This is not a criticism of Flavell et al., who make it clear that their concern is with role taking factors, but it means that studies with a bias towards investigating the specific cognitive factors operating are required.

In common with other workers in this area, Flavell et al. do not include pre-school children in their investigations of communication. This is not due to a total disinterest but the implication of their model is that effective communication will not be taking place among children of that age. They do, however, report some interesting preliminary research on role taking skills among pre-school age subjects.

A typical task used a self-standing card with a set of three different pictures on each side of the card. One side of the card was a duplicate of the other. The child was shown the identical nature of the sides of the card and then a piece of hinged cardboard was placed over both sides of the card covering the top and middle picture on each side. The cardboard covering extended beyond the edge of the picture board so that the child had clear perceptual cues for inferring exactly what pictures were covered. In two other variations the covering was placed only over the experimenter's pictures; in one case it covered just the top picture, and in the other the top and middle pictures. In these latter cases, therefore, the pictures visible to the child and the experimenter were not the same, but could be inferred from any one side through a simple inference. After each operation the child was asked: 'Can you tell me what picture I can see on my side of the card?'

Very briefly, the results showed a developmental progression with correct responses increasing up to complete success for six year olds. The performance of three year olds in contrast was relatively poor, with only 2 out of 10 children making no errors. The success rate was up to 70%, however, for ages 4 and 5.

The conclusions from their preliminary studies, and some anecdotal evidence from a questionnaire sent to parents, were that during their pre-school years children mastered certain perceptual role taking skills of the 'most global and undifferentiated sort'. Thus they learned how to infer whether a given stimulus was or was not visible to another as long as the cues were sufficiently strong. They also came to appreciate that the effect of an interposed object between child and another was that the other would not see what the child saw, but whatever was on the opposite of the object. This is not to say that the child could reconstruct the other's perceptual input from what he himself saw. The recognition was more primitive than this, namely that the other would see whatever was to be seen from the other's side. He would not, therefore, be able to cope with something like Piaget's Three Mountains problem (Piaget and Inhelder, 1956).

But Flavell et al.'s conclusions were once again ominous for communication ability in early childhood.

"It is virtually certain that a momentary recognition of perspective differences is much more likely to occur in a young child when the prediction of Other's perspective is the stated objectives of the task (explicit instructions) than when the stated objective is some accomplishment, such as the construction of a communicative message, for which role taking activity is a useful means (implicit instructions)".

(p. 181 - 182)

An issue not really taken up by Flavell et al., but one which seems unavoidable in a study of communication behaviour, is that of meaning. Communication is, after all, the transmission of meaning. As Vygotsky pointed out "a child's ability to communicate through language is directly related to the differentiation of word meanings in his speech and consciousness" (1962, p. 129). Coupled with this is the idea broached in the opening paragraphs that communication is a dynamic, two-way,

purposive process in its spoken form. Winograd, writing in the context of a computer simulation approach to language as it appears in real-life communication situations, said:

"Language is a process of communication between people, and is inextricably enmeshed in the knowledge that these people have about the world. That knowledge is not a neat collection of definitions and axioms, complete, concise and consistent. Rather it is a collection of concepts designed to manipulate ideas. It is in fact incomplete, highly redundant and often inconsistent. There is no self contained set of 'primitives' from which everything else can be defined. Definitions are circular with the meaning of each concept depending on the other concepts". (Winograd, 1971, p. 210)

Shotter (1974) also lays emphasis on the active nature of meaning:

"A sentence is something one uses to express one's meaning, and it is not an expression of a meaning itself; its meaning is a logical construction to be completed both by oneself and one's listener out of the influences exerted by one's utterance." (1974, p. 35)

And he could have added 'and the situation itself', since context will play an important part in meaning, particularly for the young child.

The theoretical approach to meaning favoured, and one which may intrude from time to time in this research, is that developed by Olson (1970, 1972). This is particularly because it has been constructed with the language user in mind. A basic contention, in opposition to Bever (1972) and others who take a more formal approach, is that sentences do not have fixed meanings, rather "the meaning of a sentence is always intertwined with the speaker's intention in uttering it" (Olson, 1972, p. 165). Shotter seems to be making a similar point when he says,

"It is just not the case, empirically, that we turn our eyes inward, shut ourselves off from our environment, and refer to some pre-established inner plan to determine what we say. We can in some cases,

but usually we do not. Face-to-face conversations are not mediated solely by linguistic rules ... rather, what seems to be the case is that we continually monitor the construction of our expressions in relation to our intended purpose" (1974, p. 36).

In his 1970 paper Olson develops what he calls a cognitive theory of semantics, though it might also be called a neo-referential theory of meaning. He rejects the simple notion that things have names, an assumption which he claims Vygotsky made, and points out that "everything has many names, and every name 'has' many things, and a theory of reference must specify how and why this is the case". (1970, p. 262). He takes up Wittgenstein's idea that "the meaning of a word is its use in the language" (1958, p. 20), and from this he develops the theme "that words do not 'mean' referents or stand for referents, they have a use - they specify perceived events relative to a set of alternatives, they provide information" (Olson, 1970, p. 263). Olson goes on to illustrate how context determines the manner in which an 'intended referent' is encoded in language. To do this he uses a paradigm case shown in Figure 1 - 1.







	EVENT	ALTERNATIVE	UTTERANCE
Case 1			... the white one
Case 2			... the round one
Case 3			... the round, white one

Fig. 1 - 1. The relation of an utterance to an intended referent.
(Adapted from Olson, 1970)

The task requires that a speaker tells a listener the location of a gold star that he has seen hidden under one of a number of blocks. The blocks are of similar size but vary in other dimensions, i.e. colour and shape. In each case the star is hidden under the same item as indicated

in the Figure, but Olson hypothesises that the speaker's messages will be different as follows: For case 1: 'It's under the white one'; for case 2: 'It's under the round one'; for case 3: 'It's under the round, white one'. Four propositions concerning word-referent relations follow from this paradigm case.

1. Words do not name things - i.e., the thing is a block but few, if any, speakers would say so because as all the objects are blocks such a communication conveys no useful information, therefore the pronoun 'one' is used.
2. Words do not simply name the intended referent, but the intended referent relative to the set of alternatives from which it must be differentiated. Although the same item (referent) is involved each time, the message varies according to the context obtaining.
3. The message does not exhaust potential properties of the target item. Depending on the perceived alternatives so different features would be reported.
4. The advantage that words have over direct perception of events is that not only do they specify the perceived referent but also the set of excluded alternatives, i.e., they contain more information than the simple perception of the event itself.

Olson recognised that these postulates would not hold under all conditions. A degree of redundancy, for instance, is often included in messages. This is frequently to the benefit of listeners, which does not mean to say that it is always put in consciously. Speakers acquire habits of including words and phrases which do not contribute to the meaning. Brown (1958) pointed out that a thing tends to be given its most common name which may also lead to more information being given than necessary. Another factor relates to the speaker's assumptions about the range of alternatives to be differentiated. Very often these are not perceptually present and this requires that the speaker must infer what alternatives

are being entertained by the listener. Ultimately this set of inferred alternatives would seem to depend on what Flavell et al. (1968) would call the speaker's ability to discriminate the listener's role attributes.

This is by no means an exhaustive account of Olson's theory, which covers somewhat wider ground than this, but the part which has been explained in some detail relates to the sort of research to be reported in the succeeding chapters. What it would be interesting to know is how Olson's model fits the communication behaviour of young children. Olson and others have carried out some work relating to this, some of which is reported in Chapters by Olson and Freedle in a volume edited by Carroll and Freedle (1972). This work will be cited where appropriate in discussions of the studies which follow.

Perhaps the main point which Olson makes is an obvious, but frequently overlooked, one, that meaning is intimately related to context. A number of writers have made the same general point. Flower, for instance, puts it this way.

"All language functions in a context. Words exist within a linguistic context and they take significance from that context. But the utterance that provides the linguistic context, or part of it, is itself set within a context of situation and derives much of its meaning from the non-verbal elements as well as from the verbal elements present in that situation" (1966, p. 143)

This area is sometimes called pragmatics, defined by Robinson (1972) as an area of enquiry in which "one is concerned to see how contextual variables are relevant to the meaning of utterances" (p. 28). Described by Robinson as a "nascent discipline", pragmatics is said to "focus on the manner in which contextual variables and linguistic features interact to change the significance of speech acts for a listener". Examples of this new discipline, if that is what it is, are starting to appear (e.g. Clark,

1973; Donaldson and Lloyd, 1974; Donaldson and McGarrigle, in press).

A related phenomenon has long been known - the young child's global perception of events and situations which make it difficult for him to differentiate parts from the whole.

"The young child has the tendency to conceive of a group as a naturalistic situation in which the single elements are embedded and from which they get their meaning." (Werner, 1957, p. 227).

One of the best recent theoretical accounts giving emphasis to context in semantic development is by Macnamara (1972). His main thesis is that "infants learn language by first determining independent of language, the meaning which a speaker intends to convey to them, and by then working out the relationship between the meaning and the language" (Macnamara, 1972, p. 1). Macnamara's definition of meaning is "those intentions which a speaker wishes to express in language" (Ibid., p. 2), though his interpretation of language is wide enough to include non-verbal aspects of communication. He assumes, after Vygotsky and Piaget, that thought is developmentally prior to language, and that during the pre-linguistic period the sort of cognitive activity that assists language acquisition such as (primitive) classifying behaviour, is achieved. In Macnamara's words, "the child's success depends on a set of cognitive strategies which function as shortcuts in the task of relating symbols to a speaker's intentions". As an example of such strategies Macnamara cites the fact that children do not form bizarre concepts to include foot and floor and exclude all else. There seem to be constraints on what will be grouped together in a concept.

"It is obvious that an infant has the capacity to distinguish from the rest of the physical environment an object which his mother draws to his attention and names. It seems clear too that in such circumstances he adopts the strategy of taking the word he hears as a name for the object as a whole rather than as a subset of its properties, or for its

position, or weight or worth, or anything else". (p. 4).

Another example suggested is that there is a differential set to attend to varying states and activities which appears after the child has acquired the names for at least some entities. Phrases like 'Daddy gone', 'Daddy sitting down' and 'Daddy washing up' make early appearances in the language.

Macnamara provides support for his thesis, which is too extensive to develop here, from various quarters, including the growth of vocabulary, syntax and phonology. Our concern is not the acquisition of language but the implications of this theory for communication behaviour. Namely, if meaning is a clue to language rather than language a clue to meaning in the young child, then the context in which communication takes place is going to be particularly relevant. If the theory is right, then in order to understand what is happening in the verbal interaction between three and four year olds, it will be necessary to observe closely the effect of material and situation both on the speaker's encoding of messages and, even more especially, on listener's interpretations. By the age of three or four, the child will have become reasonably proficient in language use and this may well affect the use he makes of the pre-linguistic strategies referred to by Macnamara, and his reliance on context.

But if this is the case, it is likely that there will still be some occasions when the child relies more heavily on context than others. One of these occasions is very probably a novel situation such as that the listener is faced in Krauss and Glucksberg's task, and to some extent which they will also face in the proposed experiments. Like strangers in a foreign land with only a limited knowledge of the language, the reliance on what can be inferred from the situation, using other perceptions and conceptual experience, is likely to be considerable. Apart from the standard aims of assessing communicative ability by various means, an additional aim will be to see what, if any, are the specific effects on

performance, and strategy even, of changing material, i.e., the context in which the utterance takes place. In pursuit of this objective, availability of a videotape record will be particularly helpful.

Summary and Aims.

In this introduction to a series of studies investigating communication in young children, the conclusion drawn from the pioneering work of Piaget was that research into communication behaviour in pre-school children would be an unproductive exercise. This was because such children were said to be very poor communicators, indeed they did not really know what it was to communicate. Piaget's explanation of this, based largely on egocentrism, was outlined. Despite such a gloomy prognosis there seemed to be a number of reasons for proceeding with the investigation.

1. Piaget's own findings suggested that the emphasis on egocentric speech was exaggerated. There was a significant proportion of 'adaptive information' in young children's socialised speech and if this could be encouraged by the experimental situation, effective communication might be possible.
2. Piaget's tasks were developed for 7 year olds and were considered fairly demanding for them. There was a case for trying simpler tasks for younger children rather than extrapolating from the results of older subjects.
3. The distinction made by a number of writers between the developmentally prior language for communication and language for abstract propositions was thought to be significant. The former was said to be dependent on action and the concrete situation and since the task envisaged represented such a context, it was believed that the conditions for 'natural' communication behaviour would be available.
4. Vygotsky's theory of egocentric speech was outlined and though it provided support for the view that young children communicate poorly, such speech was said to have a communicative intent. A possible spin-off

from the research would be examples of egocentric speech regulating cognitive strategies, giving an insight into such functioning.

5. Some of Krauss and Glucksberg's work was reviewed. It indicated that it was feasible to conduct such investigations with nursery age children. It was possible that the poor performances of the under fives was due to the choice of task. A simpler experimental situation within the known limitations of pre-schoolers was proposed.
6. It was argued that it had not been demonstrated, in any way conclusively, that adaptive communication behaviour was beyond the capacity of pre-school children. If they failed to achieve it in a conducive task situation, then it was still worth studying to try to gain further insights into the reasons for communication inadequacy and to the precursors of communication proper.

Some theoretical models of the communication process and the related issue of meaning were discussed. The implications of these theories for the proposed research were stated.

The main aims of the research may be summarised as follows:

1. To assess the communication abilities of children between three and five years in a discrimination task.
2. To determine the types of strategies used, successful or otherwise, in the roles of speaker and listener.
3. To break down the communication process, as represented in these tasks, into its constituent skills and to discover the ability level of the children when engaged in tasks designed to measure these skills.
4. To test one aspect of the egocentric hypothesis by providing the child with a partner whom he would recognise as inferior in knowledge and ability.
5. To establish some parameters of the effects of context or extra-linguistic factors (e.g. type of material) on speech production and comprehension.
6. To develop a technique for investigating thinking in the young child by having one child instruct another in a conceptual problem.

The following pages will show to what extent these targets were attained. But to end the beginning, at least, on a hopeful note, some words from Flavell et al. seem to provide adequate justification for the coming work.

"Even less is known about early communicative skills than about early role taking ones. Study of pre-school communication behaviour should at the very least provide additional - and perhaps clearer - data on the sorts of immature communication forms which we encountered in our younger school-age subjects. A more important justification for such study, however, would be the possibility of identifying forms which even our youngest subjects had outgrown, and hence of contributing something new to the developmental-descriptive picture."

(Flavell et al., 1968, p. 224 - 5)

Chapter 2. The Research Approach.

The major concerns in this series of studies have been to try to discover what makes up the communication process as well as to gain empirical data in a little explored area. This desire to go beyond the surface behaviour has demanded an intensive analysis of complete behavioural records. These twin aims have conflicted somewhat. Investigation of underlying thought processes and cognitive strategies in young children does not always lend itself to a tight experimental design with rigorously controlled variables. A frequency count of correct and incorrect responses followed by a statistical treatment may reveal certain trends, but such group data are insufficient to gain a deeper understanding. For this reason a degree of flexibility in the procedure was considered preferable, one that would allow the researcher to probe in a direction that might not have been considered initially, if an individual's performance suggested that this might be revealing. This is not to say that large scale research studies, obtaining normative data based on content analyses of communication, are without value; on the contrary they are regarded as a necessary adjunct to the approach adopted in these studies. The basic tenet here, however, is that until we have some idea about the nature of the communication process, the skills involved and the best method of investigating this area of cognitive development, a large scale study would be unlikely to prove productive.

As a preface to the research findings it will be useful to say something about the research setting and the sample used. An outline of the basic situation, the usual method of procedure and the recording and treatment of data will establish the methodological approach of the project. There were also some special circumstances obtaining ^{as} which had important effects on the course taken by this research and it is/well to

specify these at the outset.

The Cognition Project. These studies were carried out at the Cognition Project, Department of Psychology at the University of Edinburgh. The Cognition Project was set up in 1966 by Margaret Donaldson and Roger Wales under the joint auspices of the Social Science Research Council and the University of Edinburgh. The work carried out was investigations into the development of cognitive skills in pre-school children. A research nursery was set up for this purpose which 20 children attended daily during normal school terms. The staff of the Project has typically consisted of up to 9 research workers, up to 5 postgraduate students, two nursery staff and a secretary. Apart from the work on thinking and language, there has been a continuing programme of ethological work looking at various aspects of territorial, agonistic and leadership behaviour.

The Sample. The original Cognition Project sample was a homogeneous group, carefully selected from the waiting lists of Corporation nursery schools. The children were of parents engaged in skilled or semi-skilled occupations who were unlikely to leave the district during the child's pre-school years. Later, during the time the present research was carried out, the homogeneity was disturbed a little and the sample came to take on a more varied background. The parental occupations of children who took part in communication studies varied from surgeon and university lecturer to motor mechanic and unskilled labourer. Places in the nursery were not advertised and vacancies tended to be filled by siblings or friends of those already present.

Children were accepted from three years onwards. They were given a Stanford-Binet intelligence test, before entry, to gauge their performance in a test situation, rather than to obtain an I. Q. This, together with a parental interview, served to screen out children with intellectual or emotional difficulties, which was a necessary precaution in a small

sample. In fact the incidence of rejection was very low - less than 5 per cent.

The nursery was run on the lines of other Edinburgh Corporation nurseries and children attended from 9 a.m. to midday. The major difference was the number of adults interacting with the children. The ethological work consisted mainly of passive observation, while the work on language and thought used testing rooms beside the nursery area. Children were allowed time to acclimatise to the new situation before any testing was attempted and the experimenter spent many hours in the nursery setting so that the children were at ease in his company. In all, 30 children were used in the series of studies to be described, and ages ranged from 39 months to 62 months.

The Basic Task Situation and Procedure. Four types of situation were employed. The standard one adapted from that used by Glucksberg, Krauss and Weisberg (1966) had two children communicating with each other. The participants faced each other across a table. Typically they had identical sets of material which were intended as the focus of their dialogue. The verbal nature of the task was encouraged through the communicators being able to see only their own array of objects. The basic task was simple: one child acted as speaker, the other as listener, and the speaker's job was to select an object and tell the listener about it in such a way that he would know which object the speaker had chosen, since ultimately they had to match selections.

The second task situation involved a child communicating with an adult, namely, the experimenter. The basic format was similar to that described above, the difference being the measure of control possible. This situation was used to assess the various components which appeared to compose the communication skill, components which it would not have been practical to investigate in the child-child situation.

Another variation used involved a talking doll as a partner for the child. This was thought to have the advantage of control without the distorting effects which an adult must have if the main interest is communication between peers. The special circumstances of the talking doll test situation will be explained below.

A further variation occurred in the child-child communication condition. A final series of studies required the children to instruct each other in a more complex cognitive problem. The task chosen for this purpose involved ordering skills, specifically the behaviour described by Piaget (1952) as seriation. This study required that one of each pair first took part in a preview session during which the task to be communicated was acquired.

It was standard procedure to begin each study with a simplified preliminary session which served a number of purposes. It enabled the children to become familiar with the type of situation in which they would be required to operate. It allowed the experimenter some opportunity to vary and revise the procedure and task instructions if necessary. (The use of videotape in this context was invaluable (see below)). Finally it acted as a screening procedure; any child who indicated he was totally unable to grasp the simple problem was usually eliminated from the main experiment. Such a course was necessary because, apart from time considerations, in communication tasks the presence of one member, in a pair, who had a basic comprehension problem meant the loss of two, rather than one, subjects.

As far as the material used for communicating purposes was concerned, the aim was to supply objects or pictures which were sufficiently attractive to hold the child's interest, without being so exciting as to deflect the child from his communication intent nor so complex as to lead him to report a great deal of irrelevant information. A danger also lay

in using abstract material which might be meaningless in verbal terms for the child, or over-simple items which did not allow enough scope for description.

Recording and Treatment of the Data. The size of the sample and the nature of the task limited both the power of the experimental designs and the statistical treatment of data. A number of factors weighed in the decision to restrict the sample to those children attending the research nursery. One of these was the technical problem of taking television recording equipment and lighting to other nurseries or play-groups - in practice it was not feasible. Communication research does not, of course, demand television, but the type of intensive analysis of performance records which was carried out would not have been possible without videotapes. Use of the talking doll was also limited technically, as it required a specially built sound proof cubicle which could only be used at the Cognition Project.

A less obvious, but equally important factor, was the value attached to developing the necessary task conditions slowly and carefully. In the case of children of pre-school age, when the establishment of trust and rapport is so important, there are many advantages in having the research population permanently at hand. The special advantage for this research was that it enabled the development of a technique like the talking doll, and the use of communication, itself, as a method of investigating cognitive abilities. Again, this should not be taken to mean that the study of communication is only possible in such conditions. A number of studies have been reported which have not operated in such conditions, but it is argued that a real knowledge of the way communication as a skill develops, does require the sort of intensive approach that is only feasible with a sample that can be studied regularly and at length.

To return to the limitations imposed by sample size; these were

mainly felt when it might have been desirable to control for order effects. To have done so in a number of cases would have meant that the size of groups receiving the effect of interest, in the desired order, would have been too small to give any thing like a reasonable picture. These issues are discussed in the particular experiments in which they occur. It was also the case that many subjects performed in these tasks on a number of occasions. Although this might be said to be giving rise to a practice effect, in the within-task cases where it was possible to measure such an effect, no significant generalisation was evident. The only sure way to avoid possible confounding effects of this sort would have been to use different samples for each experiment. The difficulties of adopting such a procedure have already been outlined above, and it would have involved the loss of some of the important comparison effects, between tasks, which were possible. In the series of tasks which were designed to probe some of the constituent skills involved in communication, a constant sample was required to gauge the effect of such experience on subsequent communication.

Particular attention was paid in the administering of these tasks to providing instructions which were clear and comprehensible. To this end considerable use was made of videotapes. Since preliminary or pilot sessions were invariably given, the instructions could be changed when it was thought appropriate and, by studying the television recordings, their efficacy assessed. In this way the procedure which best conveyed the task requirements could be constructed.

All test sessions were videotaped and this allowed two methods of treating the data. One was a standard presentation and discussion of group data based on frequency counts, comparison of means and the use of statistical significance tests. But very often this provided only a broad guide to the behaviour and so, to gain a deeper understanding of the processes underlying such findings, it was necessary to study the

individual performances which videotapes, perhaps uniquely, allow. By assembling detailed performance records annotated from the tapes, it became possible to discern patterns in approaches used and to infer the strategies which might have accounted for them. A developmental progression, for instance, was sometimes apparent. This analysis was often aided by a prior break-down of the task into a step by step description of the cognitive components involved - a sort of prescription for success. Such a logical 'programme' provided a standard of comparison against which to assess the children's performances. The effect of such a procedure on the presentation of results is that many extracts from the test session protocols, sometimes lengthy, must be included to illustrate particular aspects of behaviour. Such a method means that the data do not always fall into neat categories and the smoothing of rough edges has been kept, deliberately, to a minimum.

As pointed out in the earlier chapter very little work has been done in this somewhat hybrid area of language, social behaviour, and the development of thought. Like much pioneering it is inclined to be messy at times, nevertheless, within the limitations mentioned, all precautions have been taken to maintain the rigour demanded of scientific research.

A note on the Talking Doll Technique. The rationale for using a talking doll in this research will be found when the relevant studies are described in Chapter 6. The purpose here is to say a little about how the technique arose and developed, and how the actual test situation involving the doll operated.

The idea of a talking doll was conceived by Margaret Donaldson as a means to obtain judgements from young children about language and the world, (Donaldson and Lloyd 1974). It was not clear at the time whether three year olds knew what it was to be in error. If they showed that they could tell when statements about a situation were right or wrong, then a method widely used in psycholinguistic research with adults (e.g. Wason

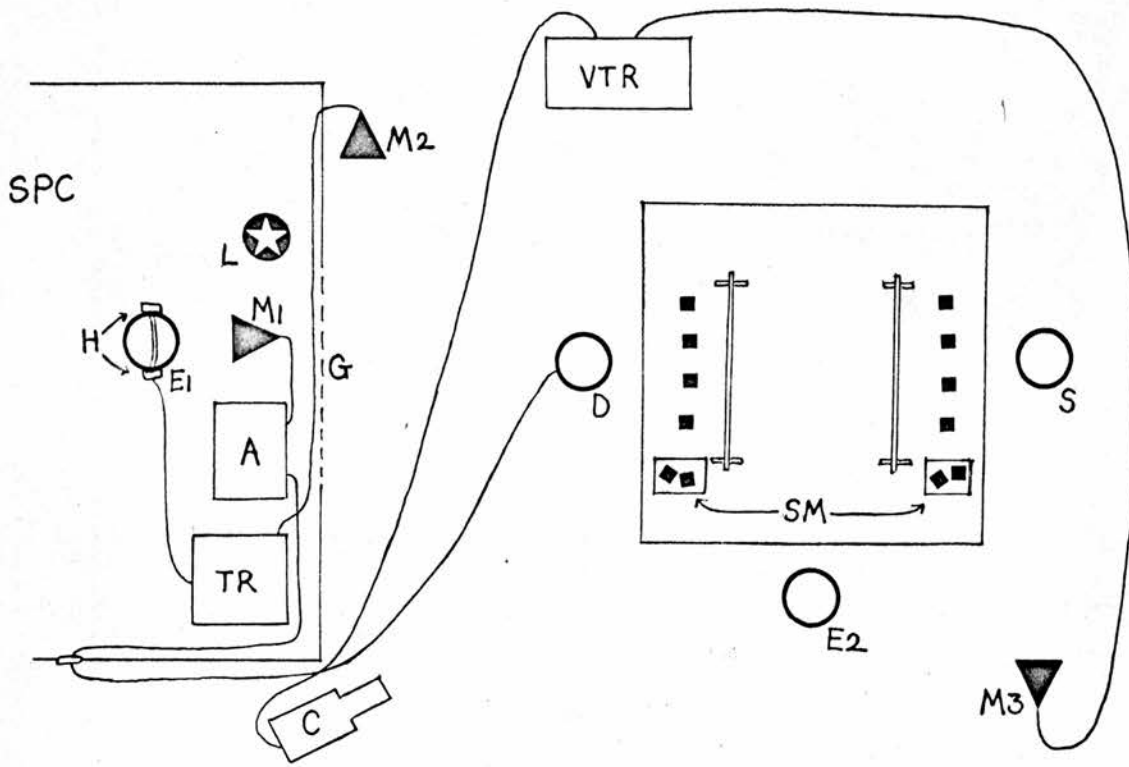
1961, Chase and Clark 1972) could be employed. It did not seem plausible to ask pre-school children to judge the truth or falsity of statements made by an adult, and of course they were not in a position to assess written statements. The talking doll was therefore invented as a source of descriptions about particular situations, with the child's role being to tell the doll when it was right and when it was wrong. The reasoning was that if the doll was presented as someone learning to talk, 'he' would be expected to make mistakes from time to time in his conversation. With encouragement, we believed that the young children, as competent but not mature language users, would be happy to help the doll in its speech development by pointing out the correctness or otherwise of its utterances. In this way we would obtain what interested us, namely an understanding of the children's own ideas about the relationship between sentences, or spoken language, and the situations they described.

To achieve the degree of co-operation required by the child in the talking doll situation, the technique was developed slowly and carefully. Initially the doll, a large toy panda called Chu-Chu, was taken into the nursery to meet the children when they were assembled as a group. It was explained that this was a special toy panda because he could talk, but that he could not talk very well as he was still learning. The children were asked if they would help the doll to learn to talk as well as they could. They were asked if they would come to see him one at a time, since he was too shy to say anything with everybody present. From this beginning the relationship was established through a series of meetings between the doll and each child. To facilitate the experimenter's interpretation of the children's judgements of the doll's statements, they were trained in the use of a device which involved sounding a bell when the doll said something which they thought was correct, and a buzzer when they thought it had made a mistake. When they signalled errors, the children were asked, by the doll, to tell 'him' why 'he' was wrong.

This early work with the talking doll indicated that children as young as 39 months were able to signal truth and falsity as they saw it. This was initially established with the doll making quite gross errors, such as calling a toy soldier a banana. Later sessions were devised to investigate comprehension of particular aspects of language such as negation and quantifiers (all, some, none etc.). These have been reported elsewhere (Donaldson 1971, Donaldson 1972, Donaldson and Lloyd 1974).

The test room lay-out for talking doll experiments is illustrated in Figure 2-1. The voice of the doll was provided by an assistant concealed in a sound proof cubicle which had a one-way vision panel through which the assistant could see the child and the material about which he was to converse. A high-level microphone in the room recorded the dialogue on a tape recorder in the sound proof cubicle. The assistant was able to monitor this through headphones. A 3" Yungch loudspeaker in the doll's head was connected to a broadcast system (microphone and Sinclair Z-12 amplifier) in the sound proof booth, and when the assistant spoke the voice came from the doll. The doll's mouth did not move and, in fact, it was in every way inanimate. This did not appear to lessen the strength of the contact between child and doll which in all cases was friendly and sometimes remarkably close, as when the doll took on the role of a confidant. The fact that most of the children were familiar with talking animals from television doubtless helped to reinforce the otherwise bizarre idea of a talking panda. It is also true that the young child's notions of reality are such as to make a situation like this - which never pretended to be more than a game - quite acceptable, (q.v. Piaget 1955).

All experimental sessions were videotaped using a Sony CV2000 videotape recorder and a Sony CVC2000B automatic camera, the $\frac{1}{2}$ -inch tapes being played back through a Rediffusion Arundel 19" television monitor.

Fig. 2-1. Test room lay-out for talking doll experiments.

- S - Subject
- E1 - Experimenter for doll's voice
- E2 - Experimenter manipulating materials
- D - Doll
- SM - Stimulus material
- C - Camera
- SPC - Sound proof cubicle
- TR - Tape recorder
- VTR - Videotape recorder
- M1 - Broadcast microphone for doll's voice
- M2 - Microphone recording room conversation for E1
- M3 - Sound recording microphone for VTR
- A - Amplifier and power pack
- H - Headphones monitoring outside conversation
- G - One-way vision glass
- L - Dim light source

Chapter 3. Pilot Studies.

Before starting the main course of experiments, two pilot studies were carried out to acquire some experience in the methodology of such research and to obtain some first hand evidence of the sort of performances to be expected. The preliminary studies will not be described in full, but the method and main findings will be outlined since some of them affected future research strategy.

The first pilot study used the standard procedure adopted by Glucksberg and Krauss (1967) but greatly simplified the task itself. The subjects in this study were three pairs of siblings taken from the research nursery. Although siblings were not chosen with any serious intent to compare their performance with that of non-siblings, it was nevertheless arranged that the subjects operated in two conditions, with a sibling and with a non-sibling, so that the subjects acted as their own controls. This was done as a somewhat crude safeguard to see if the findings were at all suggestive. The disinclination of one subject to take part effectively demolished an already precarious design, and no attempt was made to compare the two conditions.

Pilot Study I.

Each child operated as speaker and listener with a sibling and a non-sibling. The exception was the boy whose brother withdrew from the experiment. This child accordingly performed only with non-siblings. There were eight pairings in all, four with one set of materials (A) and four with another set (B). These were small plastic toys as follows:

Set A

1. Red steam ship (Short title: Ship)
2. Purple centipede (Snake)
3. Green fir tree (Fir)
4. Dark green pelican (Bird)
5. Red yacht with yellow sail (Yacht)

6. Palm tree with monkey climbing it (Palm)

Items 1 and 5 were included as being potentially confusable if a label like boat or ship was used. Items 3 and 6 might also lead to errors of identification if the description was ambiguous, e.g. 'tree'.

Set B

1. Yellow crocodile (Crocodile)
2. Doll with black trousers, blue and white striped shirt, red belt and red hat (Red hat)
3. Orange lizard (Lizard)
4. Doll with black trousers, red waistcoat, white shirt with blue spots, and black hat (Black hat)
5. False red lips (Lips)
6. Large fly (Fly)

In this set items 1 and 3, and 2 and 4 were potentially confusable.

Procedure.

The subjects operated in pairs, each taking the role of speaker and listener. They faced each other across a small table and each had identical sets of toys. The object of the task was for the speaker to select a toy and tell his partner which toy he had chosen, so that the listener could pick out the same object from his own array of toys. Small screens were placed between the subjects so that they could not see each other's toys.

Both subjects were shown that the sets of toys matched before the screens were put up. The role of speaker (or listener) was taken until all the toys in the array had been selected and described and then the subjects reversed roles and repeated the experiment.

Results and Discussion.

The performance of the speaker may be judged in terms of the adequacy of his description of the selected object, that is, whether or not it contains sufficient information to permit successful discrimination

by the listener. For example, the one word message 'tree' is not adequate as a description of the fir tree, since it may equally well apply to the palm tree. On the other hand, descriptions containing more information like 'fir tree', 'Christmas tree' and 'tree without monkey' will normally be considered adequate. The performance of the listener may be judged on the ability to pick out the intended object on the basis of the message received.

TABLE 3-1

Summed data showing number of adequate and inadequate descriptions by speaker, per task item, and subsequent correct and incorrect choices by listener.

	Speakers' Adequate Descriptions	Listeners' Choice C	Listeners' Choice I	Speakers' Inadequate Descriptions	Listeners' Choice C	Listeners' Choice I
<u>Set A</u>						
1. Boat	2	2	0	5	5	0
2. Snake	8	8	0	0	0	0
3. Fir	3	3	0	4	1	3
4. Bird	8	8	0	0	0	0
5. Yacht	5	4	1	3	2	1
6. Palm	2	2	0	6	1	5
TOTAL	28	27	1	18	9	9
<u>Set B</u>						
1. Crocodile	4	3	1	3	0	3
2. Red hat doll	0	0	0	8	3	5
3. Lizard	5	4	1	3	0	3
4. Black hat doll	0	0	0	7	6	1
5. Lips	8	6	2	0	0	0
6. Fly	8	8	0	0	0	0
TOTAL	25	21	4	21	9	12
GRAND TOTAL	53	48	5	39	18	21

*Correct

**Incorrect

Table 3-1 gives some indication of the overall performance. Out of a total of 92 descriptions, 53 (58%) were adequate. The adequate descriptions were not distributed evenly over the set of objects used. Some (snake, bird, lips, fly) were always described adequately, while others (red hat and black hat doll) never received adequate description.

An inspection of the table shows clearly that it was only the potentially confusable items 1, 3, 5 and 6 in Set A, and 1, 2, 3 and 4 in Set B that gave rise to inadequate descriptions. The reason for this was evident in the children's performance, namely, a tendency to describe items in one word. When one word, e.g. 'fly', was sufficient to distinguish the chosen object from the rest of the items, then discrimination was no problem - the description was adequate. But where two or more objects were described by the same word, e.g. 'boat', a discrimination problem arose and the description needed to be expanded to include those features which would enable a correct choice to be made.

Looking at the listeners' performance, it was largely governed by the adequacy of the description. Thus, of the 53 objects given adequate descriptions, only five failed to be correctly picked out by the listener. But, not surprisingly, the same trend did not hold for inadequately described objects. The totals at the foot of the right hand column show that the 39 inadequate messages are more or less evenly divided between correct and incorrect choices. This is because an inadequate description cannot be considered the exact opposite of an adequate message. The inadequate message will usually contain some useful information, and in the majority of cases it will limit the choice for the listener to one or two objects. A child hearing 'boat' is unlikely to think it refers to a tree or a bird, but he may be undecided as to whether it refers to the sailing yacht or the steam ship. So, if inadequate messages usually limit the listener's choice to one of two possibilities, it is consistent that the numbers of correct and incorrect choices are roughly equal as

would be expected by chance.

TABLE 3-2

Summary of descriptions used as applied to the task material

Referent Description	SET A						SET B					
	Red Steam Ship	Purple Centipede	Green Fir Tree	Green Pelican	Red Boat with Yellow Sail	Palm Tree	Yellow Crocodile	Doll with Red Hat	Orange Lizard	Doll with Black Hat	Red False Lips	Black Fly
1. Red Boat	6				2							
2. Boat	1				1							
3. Snake		3							1			
4. Lobster		2							2			
5. Beetle		3										
6. Tree			5			6						
7. Christmas Tree			4									
8. Duck				6								
9. Bird				2								
10. Sailing Boat					1							
11. Red and Yellow Boat					5							
12. Tree with Monkey						3						
13. Buffalo							1					
14. Turtle							1		1			
15. Crocodile							4					
16. Yellow Crocodile							1					
17. Hat							1				5	
18. Doll								3		2		
19. Boy								3		1		
20. Dolly								2		2		
21. Girl										2		
22. Lizard									2			
23. Fly									1			4
24. Butterfly												4
25. Red Lips											3	
Number of <u>Different</u> Descriptions	2	3	2	2	4	2	5	3	5	4	2	2
												96
												36

Figures in the main body of the table refer to the incidence of particular descriptions. E.g. No 6. 'Tree' is used to describe Fir Tree on five occasions and Palm Tree six times.

The results suggest that the degree of confusability between objects determined performance in this simple communication task. This inference is supported by the descriptions used by the subjects. Table 3-2 shows that there are nine descriptions which are common to more than one item within a single set (1, 2, 6, 14, 17, 18, 19, 20, 23) and most of them concern those objects which were predicted as potentially confusable before the experiment. For example, number 1 in the table, 'red boat', was used to refer to the steam ship and the sailing boat. Red boat is a perfectly accurate description of both toys but it is not adequate since it does not discriminate one from another. On the other hand 'lobster' (No. 4) is not^{an} accurate description of the purple centipede, but because there is nothing else in the set of toys that remotely resembles a lobster, the description proved adequate for the purpose of identification.

The case of the false plastic lips was particularly remarkable. It is unlikely that any of the children had seen such a bizarre object before and this was borne out by the fact that only one subject used the term 'lips' to describe them; the rest used the word 'hat'. Yet despite this description being, strictly speaking, inaccurate, only two identification errors were made on this item by listeners. This represents support for Olson's (1970) claim that the meaning of a word is determined by the perceived set of alternatives, that is, other referents present which may be covered by the verbal description used. 'Hat', though inaccurate, is perfectly adequate to discriminate the 'lips' in the absence of any other hat-like objects. In contrast, as we have seen, a word like 'doll' is not sufficient in this context because it only reduces the set of alternatives to two, both of which are specified by that word. This suggests that Glucksberg et al's (1966) concern of whether or not a description is regarded as egocentric, as in this case 'hat' may be so regarded, is relatively unimportant beside the issue of how the speaker

(and for that matter the listener) partitions the set of perceived alternatives.

It is of interest that the twelve objects used yielded a total of 25 descriptions, but because some descriptions were applied to more than one object, the total number of different descriptions used was 36 (see Table 3-2). If simple, and for the most part, easily recognisable objects give rise to so many different referent words, the value of using novel or nonsense drawings with pre-schoolers must be questioned (viz. Glucksberg et al., 1966). It is noticeable that the children almost invariably limit themselves to one word descriptions. In this study such a limitation was not usually a handicap, but on occasions where a more elaborate description was required (e.g. the dolls) the apparent inability to provide more information than the simple label, 'dolly', meant that a 'correct' choice between the two items answering this description would be made only by chance.

The design of the pilot study precluded much information on the relationship and interaction between speaker and listener. In fact there was very little interaction between the children although sibling pairs were involved. There were just three instances of messages being modified, to use Glucksberg and Krauss's (1967) terminology, that is, of a speaker providing additional information to a description in a subsequent message. In one case the original message 'tree' was expanded to 'Christmas tree', and 'red boat' was modified to 'red and yellow boat'. Both of these modifications resulted in making messages that were previously inadequate, adequate. For the most part the listener was a passive performer, restricting himself to repeating the speaker's message on occasions and otherwise selecting the toy he thought to be appropriate. There were no instances of the listener asking for more information.

To sum up the main findings of this pilot study.

1. With the one exception noted, the subjects appeared to enjoy and were involved in the task. In other words the method seemed to be a workable one.
2. Adequate communication tended to be restricted to:
 - (a) those items that were not confusable
 - (b) those items that could be described in one word.
3. Accurate description was not equivalent to adequate communication and vice-versa. For example, a crocodile could be described as a buffalo and the listener would still select the correct object.
4. In this limited study, successful communication was determined by the relationship between the objects rather than the intrinsic features of the objects themselves. No child showed signs of being aware of the importance of the context.

Pilot Study II

Communication was limited in the first pilot study by the nature of the material, in that for the most part one word descriptions sufficed. One change in the second study was to introduce material intended to promote more verbalisation. This was done by providing a relationship common to all the objects instead of just to one or two as in the first study. Accordingly, one theme was selected and variations on this theme introduced. In the previous experiment, this would have been achieved if all the toys had been identical dolls, each with different clothing. For the present study two experiments were carried out one using a set of drawings of houses, the other of cars, both varying in certain dimensions.

A further aim of this study was to give more attention to the instructions used, to make as certain as possible that the subjects were aware of the roles they had to play. To this end two experimenters

took part, which allowed individual attention for each child in the critical phase when the object of the game was explained.

The study was restricted to one pair of children to discover the value of an in-depth approach to the performance of children in the communication situation. It was hoped to obtain some idea of the strategies used and of how the children interpreted their roles in the task. It was also believed that such an approach might provide some genuine interaction between subjects, behaviour that was largely absent in the first study. To assist these aims intensive use of videotape recording and analysis was made.

Method.

Subjects. Two children who had not taken part in the earlier study,

Janet - 4 years, 6 months, and James - 4 years, 5 months.

Material. Two sets of six drawings of houses on white card (3" x 3").

The houses were identical in form and size but varied on a number of dimensions: colour of walls, colour of roof, smoking or not smoking chimney. Among the more obvious constant features were a black door, four windows, and a chimney.

Another two sets of six, side-on, drawings of a car were used in a second experiment. Here the changing features included colour of car, colour of wheels and presence or absence of driver. Obvious constant attributes were number of wheels, and number and colour of windows.

Procedure. The conditions for the experiment were as in the first study.

The subjects were invited to inspect the sets of pictures and place side by side those which matched exactly until they were satisfied that there were two identical sets. One experimenter sat beside Janet and one with James. The purpose of the 'game' was explained to both children and then each experimenter instructed his assigned subject in the role he was to play.

The speaker was asked to choose a picture and tell the listener all about it so that he could choose the same 'house' from his set. Small screens were again placed between the subjects. To avoid excessive periods of inactivity (and potential boredom), the subjects switched roles of speaker and listener after the selection and description of each picture, except for the first trial when roles were not reversed until halfway through the set of pictures. A trial was completed when the stock of pictures was exhausted. The session involved two such trials, and lasted about twenty minutes. On a subsequent day, the subjects returned and performed the same task with the set of car pictures. Both sessions were recorded on video-tape.

Results. As in the first study a successful performance by the speaker depended on his supplying sufficient information to allow the listener to discriminate the chosen picture. Since only three features of the pictures varied, any description which contained accurate information about these critical features allowed a correct choice to be made. But because the size of the array diminished in the course of the trial, it was not necessary to provide specification of all critical features in every case. Before looking at the ability of the children to tailor their messages according to the size of the array, the performances were assessed according to whether or not they permitted a correct choice by the listener.

The task proved well within the capacities of the subjects. In a total of 26 descriptions only two were inadequate and these were the first two of the first trial. Once the subjects realised what the task entailed, their descriptions were always sufficiently full to enable their partner to choose the identical pictures.

The subjects' descriptions were adequate, but this did not necessarily mean that they had an appreciation of which were the critical attributes in the pictures. The data given in Table 3-3 show that the children

TABLE 3-3

Descriptions by speakers given in the order
in which attributes were reported.

HOUSES				JANET		JAMES	
Card	House Colour	Roof Colour	Smoke + No Smoke -	T ₁	T ₂	T ₁	T ₂
A	Red	White	+	RSHD(5)	HRSDC(7)		
B	Red	White	-	SDR(6)		SHR(3)	HRSD(6)
C	Red	Black	-		HRDS(3)	SHR(2)	
D	Brown	White	+	HSCRD(7)			SHRD(4)
E	Brown	White	-			CS(1)	SCHRD(1)
F	Brown	Black	-		RDHS(5)	SHR(4)	SRHD(2)
CARS							
Card	Colour	Wheels	Occupied + Unoccupied -				
A	Red	Yellow	+	CWOG(3)			CWOG(1)
B	Red	Yellow	-		CWG(5)	WCOG(6)	
C	Red	White	-	CWOG(5)	CWG(7)		
D	Blue	Yellow	+	OCW(1)	COW(2)		
E	Blue	Yellow	-			WCOG(4)	CGWO(3)
F	Blue	White	-		COWG(4)	CWOG(2)	CWG(6)

Notation

Houses:

H = Colour of house

R = Roof colour

S = Smoke/no smoke

D = Door

C = Chimney

Cars:

C = Colour of car

W = Colour of wheels

O = Occupied/not occupied

G = Windows

Figures in brackets refer to order in which cards selected,



were not exclusively concerned with critical attributes. Before this table is examined some explanatory notes are necessary. In their descriptions the children are not always specific. A red house with a white roof might be described as 'It's a red and white'. In the few cases where the speakers were not specific, the context invariably made it clear to which attribute they referred.

The critical attributes are:

- (i) Houses: Colour of house (H), colour of roof (R) and presence or absence of smoke (S).
- (ii) Cars: Colour of car (C), colour of wheels (W), occupied or not (O).

Since subjects never mentioned a critical attribute without specifying its colour, the occurrence of such an attribute in the description can be taken to be a complete specification unless indicated otherwise. For this reason critical attributes will be referred to by the abbreviations listed above, H, R and S etc.

The table shows that although the children usually included all the critical attributes in their descriptions, they did not confine themselves to these. In the houses session, the presence of a chimney (C) and door (D) was frequently included in the message. When describing the cars, the speaker invariably commented on the presence of windows (G).

The number of attributes mentioned did not suggest an appreciation of critical features, that is, there was a failure by the children to restrict themselves to those features. Another possible index of their significance to the child may be the order in which attributes are reported. Table 3-3 (Houses) shows that the feature smoke, or its absence, was reported first in eight out of thirteen cases. In the cars experiment, colour was the feature reported first in ten out of thirteen cases. The second and third attributes reported were usually the critical

features: 'roof' and 'colour' in the houses task and 'wheels' and 'occupancy' for the cars.

The children, then, gave priority to the critical features in their descriptions. The constant features like door, chimney and windows tended to appear at the end of the reports. Whether this implies a genuine appreciation of the importance of the critical attributes or whether the behaviour is of a more simple perceptual nature is a matter for debate. The topic will be taken up again after the question of strategies has been introduced.

Strategies in simple communication tasks.

Thus far the descriptions used by the speakers have been described as adequate or inadequate, these being defined on the basis of whether or not they contained sufficient information to allow the speaker to pick out the item that was being described. An adequate description might not represent the optimum message however. It might contain a proportion of redundant information beyond that required for a satisfactory description. To take a simple hypothetical example, if the Chairman of a committee wished the members to turn to page 23 of a particular book or document, among a number they had before them, he would not need to describe the colour, dimensions, texture, publisher, title and author of the book; normally, one of the features and page number would be sufficient. Any communication like 'Look at page 23 of the big book/Robinson/Annual Report/pink document' would be adequate as long as there were not two items answering the same description. The use of additional information would be regarded as unnecessary and, if used habitually, irritating.

In tasks like those used in this study, it is possible to formalise the strategy which should be adopted to give minimal descriptions of items selected, that is, descriptions that contain the minimum amount of information needed to make a correct choice. The general rule should

be:-

- (i) Look for a unique attribute, that is an attribute possessed by the selected item and no other. If the item has a unique attribute, transmission of that will enable discrimination.
- (ii) If no unique attribute, look for that attribute which is possessed by the selected item and only one other item (or least number of other items) - the minimum attribute.
- (iii) 'Hold' the minimum attribute and look for the additional attribute(s) which is needed to differentiate the selected item from its subset. In effect, having determined the minimum attribute, the operator returns to stage (i) and searches for a unique attribute possessed by the selected item within its sub-set. It may be necessary to reduce the set further before a description which applies only to the chosen item can be transmitted,

In Table 3-4 descriptions based on the above rule are set beside the descriptions given by the children in the communication situation. They cover the first trial in the second session with pictures of cars. A glance at the Table will show how the rule operates. The first picture selected is a blue car with yellow wheels which is occupied. To arrive at the minimal description that will isolate this card from the rest of the cards, a unique attribute is first of all sought. In this instance there is no unique attribute, and, by rule (ii), a minimum attribute is sought. Since the car is occupied and there is only one other occupied car, this represents the minimum attribute. The task then is to distinguish the selected car from the other occupied car. Since one is red and one blue, it is a simple matter. Hence the minimal description is 'occupied and blue'. This means that when the other occupied car is selected, picture 3, the fact of being occupied is a

TABLE 3-4.

A comparison of the minimal description
with that given by the child.

CARD	COLOUR (Blue or Red)	WHEELS (Yellow or White)	DRIVER (Occupied/not occupied)	Minimal Description	Child's Description
1	B	Y	0	Occupied, blue	Man, blue, wheels
2	B	W	$\bar{0}$	Blue, white wheels	Blue, white wheels, no man, white wheels, white windows.
3	R	Y	0	Occupied	Red, yellow wheels, man, white windows.
4	B	Y	$\bar{0}$	Blue	Yellow wheels, blue, no man, blue, yellow wheels, white windows.
5	R	W	$\bar{0}$	White wheels	Red, white wheels, no man, white windows.
6	R	Y	$\bar{0}$	-	Yellow, red, no man, white windows.

unique attribute and, as can be seen in the Table, the minimal description is therefore 'occupied'.

When the child's description is compared to the minimal description, a number of differences are apparent. As the size of the array decreases so the length of the description needed to discriminate the chosen card can also decrease. This is what happens with the minimal descriptions. But the descriptions given by the children show no such decrease. They remain a more or less standard length for every card, even the last one which does not need differentiating at all. (See also Fig. 3-1).

Besides the inclusion of those critical attributes which are unnecessary to a satisfactory description of the selected card, the children also tend to include features which are common to every card - in this case 'windows' - which usually have their colour specified as well. In the first description the word 'wheels' falls into this category, since it is not qualified by colour and therefore becomes an attribute common to every car.

Though the child is not following the most parsimonious strategy - is there evidence of a pattern in his descriptions? One possible piece of evidence would be the consistency of order of report of attributes. If the child consistently followed a particular order, one might infer a plan, however crude, guiding his behaviour. From Table 3-3 some very tentative inferences may be made about the possible strategies operating. Although not strong in themselves they serve to provide an introduction to the way data in this area can be presented. They need to be discussed separately in terms of both subjects and materials.

Janet (Houses).

There is no consistent order of communication. In six messages three different first choices occur. Evidence suggests (see below) that these early trials represent a learning period for the subject during

which she adapts to the communication situation. This therefore represents the period during which a plan (if there is going to be one) comes to be formulated. There is no systematic ordering of attributes, but rather they are mentioned as they impinge on perception or perhaps, more accurately, capture attention. A relationship between the attributes may be set up in much the same way as the chain complexes described by Vygotsky (1962). For example, spatial contiguity may lead to, say, 'smoke', 'roof' and 'chimney' occurring adjacently in messages. From Janet's record there are a number of examples of this. In Trial 1 (5) 'roof' is followed by 'smoke', and in Trial 1 (7) 'smoke', 'chimney' and 'roof' are reported in succession. There is a further example in T2 (7). (See Table 3-3). A temporal contiguity may be established when the final component in one message becomes the first item in the following message either by the same subject, or the listener who now becomes speaker. It represents a sort of recency effect. A possible instance of this occurs in T1 (5) when the last feature reported by James in T1 (4), 'roof', is the first attribute reported in the following trial, T1 (5) by Janet.

James (Houses)

Six of the eight messages begin with smoke or its absence. This suggests that the subject has noticed a small specific feature with some element of action in it, i.e. moving smoke. When that feature is not present it is still the first thing transmitted.

Taking his most common sequence, James's rule is:

- (i) Look for dynamic component. Is smoke there or not?
- (ii) Next, look at most global feature - colour of house.
- (iii) Look at other critical feature - colour of roof.
- (iv) Redundant information

Janet (Cars)

Taking the most common sequence, the strategy appears to be as

follows:

- (i) Communicate the global feature - colour of car. (It might be argued that having classified the object - 'car' - the most obvious feature, in terms of surface area on the picture, is the colour).¹
- (ii) (a) When car was occupied, that was reported as second feature.
- (b) Apart from (a) (above) wheels reported as second feature.
- (iii) Redundant feature, windows.

James (Cars)

No consistent strategy apparent, though colour of car was favoured followed by 'wheels'. 'Windows' appeared as the last item in messages.

Conclusions.

These results show a marked improvement on the performances in the first pilot study. The material almost certainly had something to do with this since, as hoped, it encouraged longer descriptions.² Equally important was the greater attention given to instructions including the use of a second experimenter. It is difficult to ascertain the precise contribution of the various procedural changes and with only one pair of subjects involved it would be unprofitable. The important outcome was that the use of videotape playbacks made it possible to adopt what seemed to be the most efficient method for future studies.

1. This argument should not be taken too literally. The largest area is in fact the background colour of the card (white) or even the table on which the card was lying. In any case size of surface area is only one factor which might affect attention.
2. This may be an additional factor in explaining Krauss and Gluckberg's (1967) results; when the items in a set have a common relationship there is a greater chance of full descriptions of these items resulting. When such a common identity is lacking (or not perceived) as in Krauss and Glucksberg's task, full descriptions are unlikely.

The legitimacy of inferring cognitive strategies from the limited data available may be questioned. But it represents a potentially useful way of assessing this form of behaviour. In the beginning it was pointed out that one of the hopes was that the pilot studies might give some useful methodological pointers. It remains to follow up some of the trends emanating from these preliminary studies in experiments using larger samples and different materials.

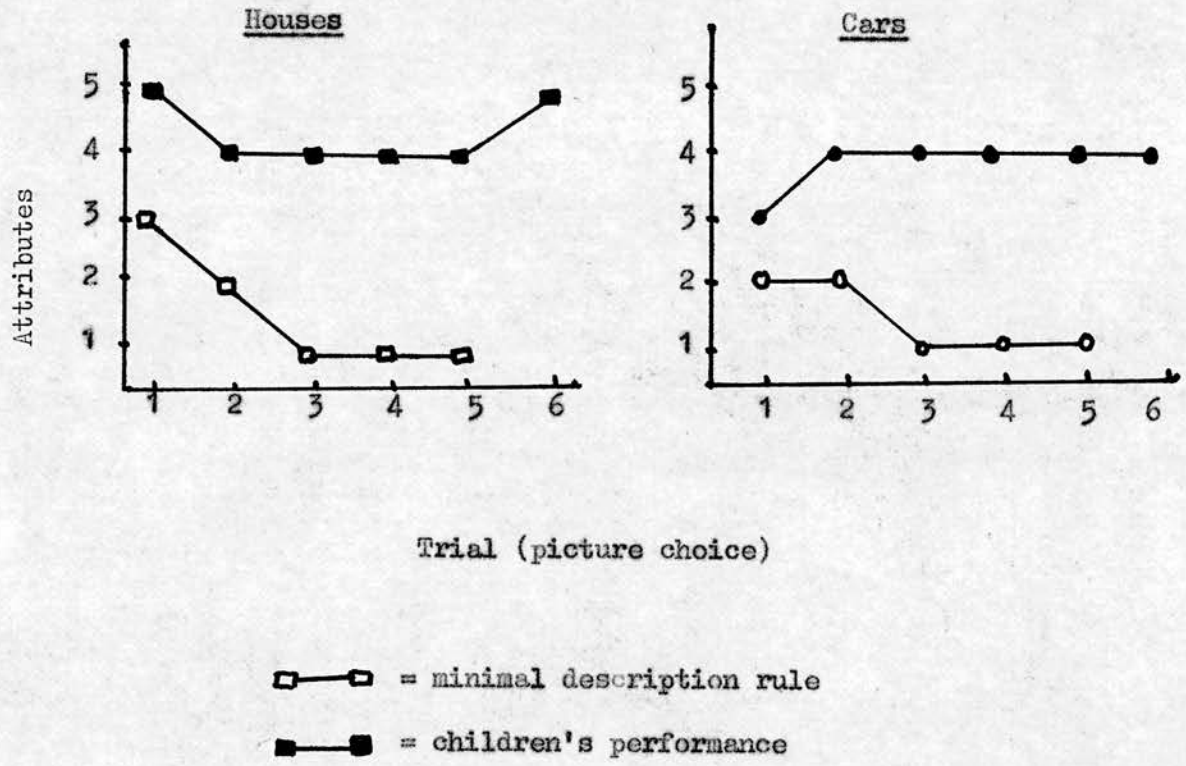
Before leaving the subject of strategies, a number of general points are worth making. The young subjects transmit a great deal of redundant information compared to the ideal represented in the 'minimal descriptions'. Yet, the totally superfluous attributes like doors and windows are almost always at the end of the descriptions. They appear as 'after-thoughts' tacked on to the end of messages. It may be that the children realise that they are never-changing components which do not affect discrimination, or they may be at the end simply because they are the last attributes to be noticed.

In both sets of materials there is an attribute which is only present in a minority (33%) of pictures - 'smoke' and 'driver'. It nevertheless appears in all but two descriptions, i.e. 92%. For these children, at least, it seems just as necessary to report the absence of an attribute as its presence. In terms of identification such negative information is of little help, since it serves only to put the object described into the majority group (i.e. those cards with no smoke or no occupants). A more effective strategy would be to report these 'occasional' attributes only when they are present, implying that no mention means not present. Whether this would be the tactic adopted by older children or adults requires testing.

Perhaps the most noticeable aspect of the task performance was the length of the descriptions. In one area at least the children are consistent, in that they give a full description in every instance. This

Figure 3-1

The child's descriptive strategy contrasted
with that based on the minimal description rule



does not include the first message in the opening trials, probably because the subject does not notice all the attributes in his first attempt. But they settle on the standard description very quickly and this remains the pattern throughout the experiment. If anything is added to the standard description, it is incorporated into future descriptions and appears in every one from then onwards. The contrast between the young subjects performance and that governed by the minimal description rule is shown in Figure 3-1. While the minimal description decreases in length as a function of trials, the children's descriptions rise to a peak and then remain steady.

There is a piece of valuable supporting evidence which suggests that the notion of strategies concerning such tasks is not merely wishful thinking. While describing a picture in the cars session, Janet was interrupted by her partner. She looked up, slightly irritated by the interruption, and after mildly chastising the listener she bent to the task again and said, 'colour first' followed by the description 'Blue and white wheels and white windows'. The phrase 'colour first' was said quietly but audibly to herself, and is taken to be a self instruction to begin the report with the colour of the car. This finding might be interpreted in the light of the Russian work on the role of self-instruction in problem solving. The work of Luria (1959) suggests that children of Janet's age would not be using such techniques, but it may be that the method is both available and employed if the right sort of task or activity is in progress. This is a question that will be reconsidered.

Finally, what can be said about the cognitive functioning of the children based on these pilot studies? If, as speakers, they see the task as saying as much as they can about a picture, then the communication situation is superfluous. ~~We would have some useful data on visual research~~ but little else. But if they have some awareness of the demands of the

situation, namely, that there is a listener needing certain information in order to make a choice, then there may be grounds for saying that the sort of higher order cognitive activity involved in problem solving is taking place. The evidence of the pilot study is, at the very least, that the children have an awareness of their roles. Communication is taking place sufficiently to suggest that the implications of Piagetian writing on egocentrism needs to be re-examined. This will be a prime object in the succeeding studies.

Chapter 4. Communication ability in a picture discrimination task.

Introduction

A question posed at the conclusion of the last section concerned the cognitive level at which children were operating in the communication situation. Did the children understand the nature of the task? Were they motivated by a recognition that a co-operative endeavour was required to complete the task successfully and that certain strategies would be more effective than others in carrying out the operation? Or was the communication incidental to the task as they saw it, namely, describing a series of pictures? A tentative answer supporting the view that an appreciation of communication was present has been given but, since the study was confined to one pair of subjects, it was necessary to repeat the experiment with a larger sample under controlled conditions.

Using the same material the design was revised to include a preview session in which the subjects were asked to say simply what they saw in the pictures, presented one at a time. This was, in effect, providing the situation referred to above - the perpetual operation which is part of the communication task, but obviously a long way short of the complete behaviour. It was hoped that this would provide some measure of the basic descriptive capacity against which the communication performance could be compared. Putting it somewhat over-simply, if the descriptions and strategies obtaining in the communication situation were essentially the same as in the simplified preview situation, then there would be reason to think that the children were not responding to the demands of the communication condition. In Flavell's (1968) terms the speaker would not be taking account of the 'listener's attributes', which might require modifying the message to suit the new situation. According to Olson (1970), the successful transmission of meaning is only possible if the speaker takes full account of the particular context,

that is perceived or inferred alternatives, relating to his intended communication. What is being suggested is that this preview task, involving straightforward picture description, has little to do with meaning in Olson's sense of the term.¹ We should expect to see a change from preview to communication condition if the subject takes account of the special circumstances involved in conveying meaning, which is really just another way of describing the communication process.

Apart from this base-line factor, there is value in knowing what features capture the attention of pre-school children when they are describing pictures. How consistent are they in both the number of attributes they report and the order in which they report them? Do the attributes which change figure more prominently in their descriptions than the unchanging attributes?

There are other differences between the preview and communication situations besides the presence of another child in the second task. The instructions are very different, being designed to encourage awareness of the communication requirements in that condition. A crucial difference already implied in the reference to Olson's theory, is that the descriptions of cards in the communication situation takes place in the presence of the other cards in the series, thus highlighting the contrasts between the pictures. But since the aim was to gain data and compare the simplest situation with the standard communication set-up, these differences were necessarily part of the comparison.

A variable which was not controlled was the precise effect of the preview on the communication performance. Ideally a control group who

1. This is not to say that the task of describing pictures is totally devoid of meaning! The fact that the child describes one picture rather than another is sufficient to illustrate this.

did not have the preview condition would have been used to assess this effect. The various methodological and sampling conditions which governed this work have already been discussed and these prevented the use of a control group. The prime purpose, therefore, was to obtain a more representative picture of communication behaviour in a situation such as that using the houses pictures.

Preview.

Method

Subjects. 18 children took part in the preview (7 female, 11 male) with ages ranging from 39 months to 58 months, the mean age for the group being 47 months.

Materials. A set of six drawings of a house, front view, on white cards three inches square. The houses were identical in terms of proportions and features, but they varied on a number of dimensions, detailed below.

Cards.

- A Red house, white roof, smoke from chimney
- B Red house, white roof, no smoke from chimney
- C Red house, black roof, no smoke from chimney
- D Blue house, white roof, smoke from chimney
- E Blue house, white roof, no smoke from chimney
- F Blue house, black roof, no smoke from chimney

Also used were four sketches of cups, which varied in two aspects, colour of cup and colour of handle, and which were used as a warm-up.

Procedure. Subjects were tested singly and shown the pictures one at a time in a random order. The instructions were as follows: 'Look at this picture. What is it? Can you tell me anything else about the picture? Anything else? Anything else? etc.' until the child had evidently finished his description. The set of cup pictures was used as a warm-up followed by the houses set. The sessions were videotaped

and lasted about ten minutes.

Results

A simple content analysis of the descriptions revealed that two main categories were involved.

- (i) Component words, which referred to components of the picture, eg. roof, windows, door, etc.
- (ii) Colour words, which sometimes appeared alone, sometimes qualified a component, and sometimes were accompanied by the child pointing to a part of the picture.

Table 4-1 shows the number of component and colour words given by each subject in the preview descriptions. The mean number of component words reported (20.8) considerably exceeded the number of colour words mentioned (8.0). A Wilcoxon matched pairs signed-ranks test confirmed that the difference was significant ($T = 36$, $p < .05$). A standard description was constructed by including all those attributes (components and colours) which appeared in at least 20% of the descriptions. Taking this criterion, the standard description is made up of five components (window, door, chimney, roof, smoke/no smoke) and five colours (house, door, roof, chimney, windows). For the six pictures this gives a total of 30 components and 30 colours, 60 descriptive segments in all. This provides a guide in assessing the performances set out in Table 4-1. The totals in the separate components and colours columns should be compared to a standard total of 30, and the combined total on the extreme right to the standard of 60.

No subject reached the total standard but three (Ss 2, 4, 16) obtained 70%, or just over, of the total. Looking at the two main categories, three subjects exceeded or equalled the standard for components (Ss 1, 2, 7) and another four exceeded 75% (Ss 9, 13, 10, 6). Only one subject (S4) achieved the standard for colours, and one other (S15) managed 75%. It is noticeable that these children were

TABLE 4-1

Number of component and colour words given by each
subject in preview descriptions of 6 pictures

<u>SUBJECT</u>	<u>AGE</u>	<u>COMPONENT WORDS (CP)</u>	<u>MEAN $\frac{CP}{6}$</u>	<u>COLOUR - WORDS (C)</u>	<u>MEAN $\frac{C}{6}$</u>	<u>CP. + C</u>
1	4:10	33	5.5	0	0	33
2	4:7	32	5.3	12(3)	2	44
3	4:6	18(5)	3.0	3(3)	0.5	21
4	4:6	6(4)	1.0	37	6.2	43
5	4:3	19	3.2	0	0	19
6	4:2	25	4.2	0	0	25
7	4:1	30	5.0	4(3)	0.7	34
8	4:0	20	3.3	16(5)	2.7	36
9	4:0	28	4.7	3(3)	0.5	31
10	3:10	26	4.3	2(2)	0.3	28
11	3:10	20	3.3	1(1)	0.2	21
12	3:7	19	3.2	1(1)	0.2	20
13	3:6	26	4.3	1(1)	0.2	27
14	3:5	21	3.5	0	0	21
15	3:5	7(3)	1.2	24	4.0	31
16	3:5	22	3.7	19	3.2	41
17	3:3	8(3)	1.3	17	2.8	25
18	3:3	15	2.5	2(2)	0.3	17
Mean		20.8	3.5	8.0	1.3	

Number in brackets indicates total number of cards described which
 contained a component or colour word if less than 6

the poorest performers in terms of number of components mentioned.

On the basis of this data it may be legitimate to talk about colour-conscious and component-conscious perceivers. Into the former category would fall Ss 4, 15, 17, while the majority of the subjects would be classified as component orientated, most notably Ss 1, 6, 7, 9, 10, 13. A further highlight on this dichotomy was that only one subject (S16) included more than 50% of the items in both categories.

To be a successful communicator, it is necessary to include those features which allow the listener to discriminate the selected card. These critical attributes, as they have been called, include colour of house, colour of roof and presence or absence of smoke. These attributes transcend the boundaries of the component and colour categories - both are involved. The fact that subjects choose to describe pictures in terms of colour or parts of the picture, but not both, was an unfavourable sign for good communication. A further breakdown of the performances was necessary, however, before such a gloomy conclusion could be drawn.

The critical attributes were so called because they were the only features which changed and as such identified the picture. It might be expected that features that change would figure in the descriptions by the children, since change or novelty is thought to be a factor which affects attention. This has been most clearly demonstrated in the auditory modality (Maccoby 1967), but some work has also been done on visual attention (Vurpillot, 1968, Maccoby and Hagen 1965). Table 4-2 shows, however, that this effect did not seem to be taking place in this context. There were three critical attributes involved in any one picture as shown at the top left of the Table. In the case of the colour of the roof, both the component and the colour needed to be included if the description was to be sufficient. It was largely because of this that only two subjects achieved one description which contained all

TABLE 4-2

Distribution of critical attributes included in descriptions for each subject.

SUBJECT	CRITICAL ATTRIBUTES			TOTAL (out of 18)	TOTAL (all attributes) i.e. critical + others	Descriptions including all critical attributes
	HOUSE Colour	ROOF Component and Colour	SMOKE			
1	0	0	2	2	33	0
2	3	2	3	8	44	1
3	3	0	0	3	21	0
4	5	1	3	9	43	0
5	0	0	0	0	19	0
6	0	0	2	2	25	0
7	1	1	6	8	34	0
8	1	3	1	5	36	0
9	3	0	4	7	31	0
10	2	0	1	3	28	0
11	1	0	0	1	21	0
12	1	0	0	1	20	0
13	1	0	1	2	27	0
14	0	0	5	5	21	0
15	3	1	0	4	31	0
16	1	6	2	9	41	1
17	6	1	1	8	25	0
18	2	0	4	6	17	0
TOTAL	33	15	35	83	517	2

three discriminating features. Since there were six pictures in all, and 18 subjects were tested, this was two out of a total possible of 108. Looking at the critical attributes in sum, 83 such attributes were mentioned out of a total of all features identified in descriptions of 517; critical attributes thus accounted for 16% of the total. Only two subjects included as many as half of the total number of critical features, while nearly half the subjects managed fewer than four such features in their descriptions. A statistic not included in the table is that, of the 108 descriptions, 46 (42%) did not contain any critical attribute.

It transpired, then, that rather than pick out and report the changing feature, these young children preferred to describe those features which were unchanging like door, roof and windows. A remarkable 84% of their output fell into this category. Table 4-3 shows that the features reported most often, in nearly every description, were windows, door and chimney, which are constants. Roof was reported on 68% of occasions but colour of roof, which is critical, only 25%. The contrast in frequency between components and colours is again shown clearly. It should be pointed out that this table includes only the main features described. In sum, more than twenty separate aspects were picked out.

To return to critical attributes - these remain the key to successful communication. Although there was no pressure or necessity to report these features in the preview situation, the degree to which they figured was of interest not only in predicting performance in the subsequent communication session but also as a clue to young children's visual perception and attention. A question to be asked was - when critical attributes did appear, were they at the beginning of the report? It has already been pointed out that since the cards were presented one by one, the differences between them were not available as a direct

TABLE 4-3

Frequency distribution of main picture attributes expressed as
percentage of total number of descriptions (n) where (n) = 108.

Windows	88	Colour of house	33
Door	85	Colour of roof	25
Chimney	82	Colour of door	25
Roof	68	Colour of chimney	20
Smoke/no smoke	33	Colour of window	19

comparison. But, if the showing of successive cards led the child to recognise the critical attributes as distinguishing features, it might be expected that he would report them first. In a communication task the most efficient strategy would be to report them first (and exclusively). Inspection of the data revealed that 58 out of the 83 critical attributes appeared at the beginning of the report. Thus when they were noticed there was a tendency in the ratio 2:1 to report such information at the start of descriptions.

Although critical attributes did not play a large part in the preview descriptions, another possible indication of a strategy, discussed in the previous chapter, was the reporting of the attributes in a consistent and systematic order. Table 4-4 contains data pertinent to this question. For each subject a modal order of attributes has been calculated, based on the modal position in which attributes in all six descriptions appeared. So for S1 the order R.C.S(2).W.D. means that the pictures were usually described in the order roof, chimney, smoke, window and door. The figure in brackets indicates how many times the attribute was reported when less than six.

Because Table 4-4 ~~is~~ based on modal positions it does not indicate the degree of consistency achieved by the subjects in their order of report. In fact no subjects were consistent, though some achieved three or four identical descriptions among the six given, notably S's 2, 9, and 13. Yet, although subjects could not be called consistent in the sense of following an identical order for every description, there was evidence of a pattern. It can be seen that Roof, Chimney, Window and Door are the main features reported. Many subjects reported Roof and Chimney (and sometimes Smoke) - the 'upper' attributes - in successive positions, while Door and Window - the 'lower' attributes - also had a high probability of adjacent report.

TABLE 4-4

Modal order of reporting attributes (Preview)

SUBJECT	POSITION					
	1	2	3	4	5	
1	R	C	S(2)	W	D	
2	W	D	R	C	S	
3	W	D	R	C		
4	R	S(3)	C	D	W	
5	W	D	C	R		
6	W	R	D	C	S(2)	
7	S	D	W	C	R	
8	R(4)	W	C	D(4)		
9	S	D	W	R	C	
10	C	W	D	R		
11	W	D	R	C		
12	C	R	W	D		
13	W	D	C	R	S(2)	
14	S	C	W	D		
15	D	W	C(4)	R		
16	D	R	C	W	S(2)	
17	R(2)	D(4)	C(2)	W(4)		
18	S	W	D(2)	-		
TOTALS						T
R	4	3	3	5	1	16
C	2	2	7	5	1	17
W	6	4	4	3	1	18
D	2	8	3	4	1	18
S	4	1	0	0	4	9

R = Roof; C = Chimney; W = Window; D = Door; S = Smoke

Figures in parentheses indicate when feature not reported for every picture, i.e. less than 6. (For explanation, see text)

The question of which set of attributes was reported first is open. Inspection of Table 4-4 shows that as many trials were started with a lower attribute as with an upper one. Individual subjects did tend to favour either a Lower \longrightarrow Upper order of report (Ss 2, 3, 5, 15, 17, 13, 11) or an Upper \longrightarrow Lower (S1, 4, 14, 12). Presumably if accurate eye movement films could have been made similar to those made by Vurpillot (1969), they would have shown some subjects scanning the top half of the picture first, reporting attributes as they were noticed, then switching to the bottom portion of the house. Others would have functioned in the opposite direction.

Some fell into neither pattern, and operated on a U \longrightarrow L \longrightarrow U plan. Ss 7 & 9 are examples of this. They began with Smoke, then switched to reporting Door and Window, before returning to Roof and Chimney. It could be that the possible 'action' properties of smoke, mentioned in the previous chapter, caught the attention of these children, and superceded all other features. After that, they operated on a Lower-Upper perceptual plan.

The pattern followed by five subjects (6, 8, 10, 18, 16) does not fit into any of the above categories and probably represents a random movement between various portions of the picture

Summary of Preview Findings

1. Subjects tended to report parts of the picture or colours in the picture but seldom an equal proportion of both. Since successful communication required inclusion of both categories, colour or component consciousness did not augur well for communication performance.
2. The children much preferred to talk about those features of pictures which remained constant rather than the changing or critical features.
3. When the changing aspects were included in descriptions they tended to be reported first.
4. Features that were topographically adjacent were reported as a group, and the strategy was to report the lower and upper cluster of features separately, with the lower attributes tending to be described first.
5. Despite the simple nature of the material, over twenty separate features were distinguished in all by the subjects.

Communication Condition

Method

Following a trial run with the cup pictures (see below), ten of the original eighteen subjects were found suitable for use in the communication experiment.¹ They were divided into pairs, matched for age, which ranged from 41 months to 58 months, average age, 50 months.

The subjects faced each other seated at a table. The experimenter was seated at the side of the table, flanking both children. The twelve picture cards, two copies of each type, were laid face up one at a time between the subjects so that the matching pairs were adjacent. The experimenter pointed out the matching nature of the two sets, but nothing about the differences within them. When the children were satisfied they had equivalent arrays, each set was moved across and placed in a random order in front of the respective children. 6" high screens were placed behind the cards so that they were hidden from the child opposite, but the children remained in full view of one another.

Instructions

In the following instructions, Jack is the hypothetical listener and Jill the speaker: 'This is a game you play together. I want you to help each other. Will you do that? Will you help Jack, Jill, and will you help Jill, Jack?

'Now, you both have the same pictures in front of you, don't you? Jack's pictures are just like Jill's pictures. In this game we take it in turns to go first. You go first this time Jill. I want you to choose one of the pictures and then tell Jack which picture you have

1. Selection criteria have necessarily to be severe, since in the communication situation, a non-participating child means the loss of two subjects.

chosen. But you must not show the pictures to Jack, and Jack, you must not show your pictures to Jill. Jack, I want you to listen carefully to Jill and see if you can pick out, from your pictures, the picture that she chooses.'

'Now, which one are you going to choose, Jill? That one! Now tell Jack which one you have chosen, but don't show him. Jack, listen carefully to what Jill says.'

'Now, Jack, which one do you think Jill has chosen? That one? Let's see shall we?'

At this point the subjects were asked to place their selected pictures face down in the centre of the table. The pictures were then turned up. E asked, 'Are they the same? Is this picture just like this picture?' When unlike pictures were adjudged the same, E said: 'Are you sure? Look at them carefully, is this picture just like this picture.' If the children still failed to see the difference, E said 'No, they are not the same, do you know why?' If no reason was forthcoming E pointed out the difference, the pictures were returned behind the screens and the speaker was asked to choose again. If, however, a correct choice was made, the pictures were left in the centre of the table. The listener became the new speaker and the procedure was continued, the children alternating as speaker and listener until all the pictures had been successfully identified.

A second trial was given in which the child who had been the listener in the first communication of trial 1, acted as speaker for the first message and then alternated as before.¹ The session was terminated at the completion of this trial.

1. In fact the second trial was given to only two of the five pairs. One trial was judged to have **taxed** sufficiently the concentration of the remaining children. (See Table 4-8).

Introductory session

Since the communication situation was a novel one for the children, they needed a certain amount of encouragement and help initially. For this reason subjects had a separate introductory communication session using items from a different picture set: the cups that were used in the preview. The procedure was as described above, but with the experimenter playing an instigating role where necessary. Thus, if the children seemed disinclined or unable to communicate, the experimenter would suggest the following:

'Tell Jack what you see in your picture. Tell him about your picture, so that he can choose the same one from his pictures.'

To the listener: 'You can talk to Jill if you like, Jack. You can ask her questions if you like. Help each other so that you choose the same picture.'

Despite such help, some children showed that they were unable to understand the purpose of the task and their role in it. Accordingly they were not asked to take part in the main experiment. As noted earlier, eight of the original pool were dropped for this reason. The communication pairs were made up on the basis of performances in the introductory session which will not otherwise be discussed further.

Results

The results fall into two parts:

1. A comparison of the performances in the communication task with those in the preview condition.
2. The children's ability as communicators, which, as in the second pilot study, depended on their appreciation of the critical factors involved.

In the preview session a contrast showed up in **the number** of colour and component words reported. It appeared there were colour-conscious and component-conscious subjects. Both types of attribute

are necessary in adequate communication and this fact seems to be reflected in the results. Table 4-5 shows that the mean number of colour words reported rose from 1.69 to 2.6, while the mean number of component words reported dropped from 3.67 to 3.3. A Wilcoxon matched-pairs signed-ranks test was conducted on these results and neither difference was found to be significant, though in the case of colour words, 8 out of 10 subjects showed an increase. The overall effect was to reduce the disparity between the number of component and colour words reported. Subjects no longer fall so clearly into the colour conscious or component conscious categories.

This trend is supported in the critical attributes data. Table 4-6 shows that the mean number of critical attributes reported increased from 0.93 to 1.76. This difference was significant ($p < .005$). Inspection of Table 4-6 shows that many of the increases were marked, in some instances doubling the preview score. It also appears that the size of the increase was governed by the original number of critical attributes included in the preview situation. To test the strength of this relationship a Spearman rho was calculated and the obtained value of +0.56 was significant at the .05 level. This correlation would have been higher, but for two factors working against each other. The one subject (S2) to show a fall in critical attributes was paired with S1, the poorest performer, so tending to bring down S2's score, while the subject to show the highest rise (S5) from 0 to 2.1 was paired with the best performer (S4) which may have led S5 to score above her true ability.

Table 4-7 shows the frequency of report of the main attributes. The preview figures are included for comparison. The pattern stays as it was, component attributes taking precedence over colour attributes, but there are notable differences of degree. This is most clearly reflected in the range statistics. In the preview it was from 19 to 88,

TABLE 4-5

Mean number of components and colour attributes
per description as function of condition

Subject	COMPONENTS		COLOURS		TOTAL	
	Preview	Communication	Preview	Communication	Preview	Communication
1	5.5	3.25	0	1.4	2.75	2.3
2	5.3	2.6	2.0	2.7	3.65	2.65
3	3.0	0.3	0.5	1.0	1.75	0.65
15	1.2	1.5	4.0	1.0	2.6	1.25
4	1.0	4.1	6.2	4.5	3.6	4.3
5	3.2	2.9	0	4.3	1.6	4.1
7	5.0	3.4	0.7	3.6	2.85	3.5
9	4.7	3.1	0.5	2.75	2.6	3.0
8	3.3	3.75	2.7	3.75	3.0	3.75
10	4.3	4.2	0.3	1.0	2.3	2.6
T	36.70	33.10	16.9	26.0	26.70	28.10
M	3.67	3.3	1.69	2.6	2.67	2.81

TABLE 4-6

Mean number of critical attributes per description
included for preview and communication

<u>Subject</u>	<u>Preview</u>	<u>Communication</u>
1	0.3	0.75
2	1.7	1.4
3	0.5	1.2
15	0.7	1.2
4	1.7	2.3
5	0	2.1
7	1.5	2.9
9	1.2	2.6
8	1.0	2.0
10	0.7	1.2
	<u>0.93</u>	<u>1.76</u>

TABLE 4-7

Comparison of all main attributes reported
in Communication and Preview conditions.

Figures expressed as percentages of the total number of attributes
it was possible to mention in each case.

<u>Attribute</u>	<u>Communication</u>	<u>Preview</u>
Colour of house	77	33
Door	69	85
Windows	68	88
Smoke	59	33
Roof	57	68
Chimney	55	82
Colour of door	52	25
Colour of windows	49	19
Colour of roof	46	25
Colour of chimney	42	20

a range of 69. In communication it is 42 to 77, a range of 35. The range has therefore halved and accordingly reduced the dominance of some attributes over others. Redundant features like door and windows continue to play a major role but their inclusion is not automatic as it once was. An important change is that two critical attributes now assume a much more prominent position, colour of house and smoke, and even colour of roof appears in nearly half the descriptions. This provides support and background to the data given in Table 4-6. One of the effects of the communication situation appears to be to bring the critical features to the fore. This must now be considered in the context of the communication performances.

The children as communicators

The criterion of success in a communication task varies according to the role played. A speaker's ability is measured by the adequacy of his message - in terms of the current task, does the message contain sufficient information to enable the listener to discriminate the chosen picture from the set of pictures? A message which fulfils this requirement is called an adequate description. Inspection of Table 4-8 shows that only two subjects (7, 8) were uniformly successful with their messages and two others came close to this performance (5, 9). At the other end of the scale one subject (1) failed to achieve a single adequate description. (It should be pointed out that 'last' pictures are not included in the data. It is impractical to talk about an adequate description in the case of the final picture, where no discrimination on the part of the listener is required). Two other subjects (3, 15) managed only one adequate description each. Looking at the results overall, in terms of speaker effectiveness, 30 out of 66 messages (45%) were adequate. Thus in this small sample over half the descriptions given by the children did not enable their listening partners to make the correct choice of picture.

The index of listener effectiveness is the choice of the correct picture. A priori this would seem to be a function of message adequacy, but Table 4-8 shows that this was not the case. The 35 correct choices were made despite only 30 adequate descriptions. Chance was obviously playing a part. This overall result is distorting the true picture since the 30 adequate descriptions did not all yield correct choices.

TABLE 4-8

Abilities of children as speaker and listener
in the communication situation

SPEAKER				LISTENER		
Dyad	Subject	Total No. of Descriptions	No. of Adequate Descriptions	Selection of Pictures		Subject
				Correct	Incorrect	
A	(4	9	5	2	7	5)
	(5	4	3	3	1	4)
B	(2	3	1	3	0	1)
	(1	2	0	2	0	2)
B	(2	8	3	2	6	1)
	(1	8	0	3	5	2)
C	(7	5	5	3	2	9)
	(9	3	2	2	1	7)
C	(7	3	3	3	0	9)
	(9	2	1	2	0	7)
D	(3	5	1	3	2	15)
	(15	6	1	2	4	3)
E	(8	3	3	2	1	10)
	(10	5	2	3	2	8)
TOTAL		66	30	35	31	

*See note at top of next page

*As previously explained, only two pairs took part in a second trial.

This gave 7 trials in all. Since each trial consisted of five pictures to be discriminated (ignoring the last item), that gave a total of 35 items to be described and selected. Because a trial was only completed when all pictures had been correctly identified, this necessarily gave a total of 35 correct selections by the listeners (column 4). The total number of descriptions was greater than this because not all messages were adequate, and even when they were they did not always lead to a correct choice by the listener. This required that fresh descriptions were given until the correct choice was made.*

Table 4-9 shows the extent of the variability. Ten of the 30 adequate descriptions were not identified correctly. A majority of the subjects made at least one error, with one (S5) having more wrong than right. Only one subject (S7) was consistently accurate in this regard since the others without error (S's 2, 15, 3) were given little or no opportunity for error by their partners (i.e. the speakers communicated either one or no adequate descriptions). Thus, of the 35 correct choices, 15 were based on inadequate descriptions and, as such, amounted to guess-work. (As pointed out in the pilot study, however, the guess work may be more or less systematic since an inadequate description may contain one critical attribute on which the listener can base his decision. Further, those pictures chosen correctly might also have been subject to chance, since even with the full set of six, there is a 0.17 probability of getting the right answer by chance. This probability increases as the pool diminishes).

When the results of the pilot study were discussed, the question of strategy was raised. The full data is not given here for reasons of space but the order of report for each subject is summarised in Table 4-10. From this it may be deduced that subjects had some recognition of the priority of the critical features. Signified by the letters H, S and

TABLE 4-9

Distribution of correct and incorrect choices
by listener as a function of description adequacy by speaker

Listener	TYPE OF DESCRIPTION				Speaker
	ADEQUATE		INADEQUATE		
	Correct	Incorrect	Correct	Incorrect	
(4 (	2	1	1	0	5))
(5	2	3	0	4	4)
(1 (	2	2	3	4	2))
(2	0	0	5	5	1)
(7 (	3	0	1	1	9))
(9	6	2	0	0	7)
(8 (	1	1	2	1	10))
(10	2	1	0	0	8)
(3 (	1	0	1	4	15))
(15	1	0	2	2	3)
Correct	20		15		35
Incorrect		15		21	31
					<u>66</u>
					—

TABLE 4-10

Modal order of reporting attributes

Subject	1	2	3	4	5	6		Preview
1	H	C	R	D	W			RSCWD
2	S	H	D	W	R	C		WDRCS
3	H							WDRC
4	S	C	R	H	W	D		RSCDW
5	H	S	R	W	C	D		WDCR
7	R	S	H	D	W			SDWCR
8	S	R	W	D				RWCD
9	H	S	R	C	D			SDWRC
10	H	R	C	W	D	S(2)		CWDR
15	H	W						DWCR
TOTALS							T	
H	6	1	1	1	0	0	9	
D	0	0	1	3	2	2	8	
W	0	1	1	3	3		8	
S	3	3	0	0	0	1	7	
R	1	2	4	0	1	0	8	
C	0	2	1	1	1	1	6	

Notation:

H = Colour of house

C = Chimney

R = Roof (and colour)

D = Door

S = Smoke/no smoke

W = Windows

R in the table, it will be seen that these attributes largely occurred at the beginning of reports. 'House colour' dominated the first position and 'smoke' tended to be in first or second position. 'Roof' and its colour was also reported in one of the first three positions, in ^{the} seven out of eight cases where it was mentioned at all. The order of reporting critical (H, S, R) and non-critical (C, W, D) attributes was compared. For this purpose subjects were given scores based on the positions in which they reported features. An attribute reported at the beginning of a description, position 1, received a score of 6, and the weighting decreased successively down to a score of 1 for attributes reported in position 6. In this way a total score for each subject for the two sets of features was compiled. A Wilcoxon matched-pairs signed-ranks test showed that the difference was highly significant, ($p < .001$)

The descriptions also contained the non-changing redundant features, and, as has already been stated, these were very consistent components in the speaker's messages. For this reason there is no question of the children operating with a strategy that compares to the rule for minimal descriptions (see page 54, Pilot Study 2). There is never any evidence of descriptions decreasing in length as the size of the picture pool diminished.

All that can be said with confidence is that the main effect of the communication situation was to bring the critical features to the speaker's attention, and hence the beginnings of behaviour appropriate to successful communication was making its appearance.

To put the above statement in context it is worthwhile at this point to consider some of the behaviour that typifies the children's performance in this task.

Individual Records

In the communication situation an individual's performance can only be discussed in relation to his partner in the dyad, since successful communication is dependent on the complementary roles of speaker and listener. Since each speaker (or listener) only performed this role with one other child any conclusions drawn can relate only to this limited situation.

Some general points can be made. Much behaviour in this situation might be considered, after Piaget (1926), egocentric. Children would often point at the part of the picture to which they were referring and say 'That's black', apparently not realising that the other child could not see what was being referred to. The pointing behaviour itself might not be simply egocentric, but an aid to the child in systematically progressing through the various parts of the picture as he made his description.

The experimenter himself had a communication problem in this task - that of transmitting the instructions. It was evident that these had not always been comprehended. One subject appeared only to understand her role as a speaker, so that when her partner completed a description to her as listener, instead of selecting the picture to which she believed it referred, she began a description of the picture of her choice. Apart from the inadequacy of descriptions, many of the failures in communication were seen to be on the listener's part. His was the passive role and, as might be expected, young children were not always inclined to sit quietly and listen attentively, especially if the child on the other side of the table was carrying out the more stimulating job of describing a picture. It was noted that on some occasions the listener had made his choice of picture when the speaker had only just begun his message, suggesting that the choice was quite independent of the description. At other times a listener, having

heard the message, might make a choice, and then, apparently arbitrarily, change his mind and select a different picture. It appears therefore that even if he was aware of his part in the task, the listener had difficulty in subordinating his own desires to the requirements of the task.

Further evidence that the children had not appreciated the essential skills of the communication task is provided by their behaviour on the ultimate picture in a trial. When both members of the dyad had one picture left, since they had been shown originally that the sets were identical and that the pictures discarded were the same, then it was necessary that the pictures which remained would also be identical. As such communication was unnecessary. The young children did not appear to appreciate the logical necessity of this situation and proceeded to give the usual full description for the final picture. (Whether this was a failure in comprehension of instructions or a basic inability dependent on developmental level is open to question and will be discussed below.)

Though the subjects were encouraged to ask questions of each other, little or no communication of this sort took place. No subject ever asked his partner for further information if the message received was inadequate. The nearest approach to this was when one subject responded to the first description of her partner with the query: 'Not a roof?' This is significant for it shows that the child was listening to the message and checking it off against the pictures in front of her, such that she noticed an omission. Her partner seemed to pick up the same behaviour towards the end of the session. In neither case, however, were the references to critical attributes. Those exchanges that did take place between subjects were usually between trials. A common activity was counting aloud the number of pictures in front of the subject. Both members of the dyad tended to do this, one echoing the other. It

appeared to give them a lot of amusement, much laughter ensuing on each occasion.

To conclude discussion of this study, and in an attempt to impose some sort of order on a profusion of data, a 'balance sheet' has been drawn up. The assets of this balance are 'good communication and what gives rise to it', while the debit side looks at what characterises poor communication (see 4-11). Taking this as a blueprint, the next stage of the research was to try to tie down some of the factors which were thought to underly this aspect of cognitive behaviour. The next section, therefore, represents a dissection of the communication task and some testable hypotheses which grew out of it.

TABLE 4-11

Communication Balance Sheet

ASSETS

In terms of the performances in the present study

good communication

is marked by:

1. Adequate descriptions, i.e. inclusion of critical attributes in message.
2. Critical attributes appearing at beginning of report.
3. Tendency to leave out irrelevant attributes.
4. Lack of bias in favour of colour attributes or 'components'.
5. Co-operation between subjects - exchanges which lead to modification of description.
6. As listener, attention to message, measured by correct choice after adequate descriptions.

LIABILITIES

Poor communication is marked by:

1. Inadequate descriptions, i.e. lack of critical attributes in messages.
2. Failure to emphasise critical attributes - located in middle of

rambling message.

3. Inclusion of irrelevant attributes.
4. Bias in favour of colours or components.
5. 'Egocentric' behaviour (1) Pointing at picture
(2) Stating colour without specifying referent
6. Failure to perceive differences in pictures when a mismatch.
7. Inability to profit from feedback, when cause of mismatch pointed out.
8. Basic misunderstanding of task - treated as game of choosing and talking about pictures. 2-role aspect ignored.
9. Errors in choosing by listener despite adequate description.

Chapter 5 Four studies investigating some of the skills involved in Communication

The main findings of the preliminary research were summarised in the 'balance sheet' presented at the end of the previous section. They provided a starting point for the subsequent research programme. Perhaps the first thing to note was that the results thus far were hopeful. In terms of error scores young children performed these tasks much better than theories of role taking and egocentrism would predict. Communication in pre-school children seemed to be an area worth investigating. At the same time the way in which the majority of subjects engaged in the tasks was inefficient, and a number of them did not seem to appreciate the type of problem they were engaged upon.

There seem to be two issues here, one relating to the level of skill possessed to carry out the task, and the other concerning an understanding of what the task involved. For instance, one may understand perfectly the rules of the game of bridge or tennis, yet perform poorly at these games because of deficiencies in some or all of the abilities required. These abilities are usually more clearly defined in physical tasks than mental ones, but such activities resist analysis because in breaking them down the essence of the behaviour, which is the totality, is liable to be lost. This has not prevented psychologists, in particular, trying to do this, and some attempts to analyse communication behaviour were discussed in the opening chapter.

Returning to the comprehension aspect, a minimal linguistic knowledge must usually be assumed, but unfortunately language is a notoriously poor method of instruction especially for children inexperienced in the medium. When we wish to explain someone's role in a game, even as simple as tiddlywinks, it is much more effective to illustrate by example or let the beginner learn by active participation.

The student of behaviour is in a dilemma because he wants to

measure the real level of the child's competence to carry out a particular act, without biasing the result through the method used to describe the said act. With children this hope is probably a forlorn one, though in some cases intelligent observation can compensate for the limitations which we are almost bound to occur in even the most carefully planned presentation. This is not the place to go into the many ways in which psychologists have sought to overcome the problems of investigating their own kind, instead it will simplify the discussion if it is confined to the type of task used in these communication studies.

Although it has been argued that language is inefficient, it cannot be avoided because it is so central in communication. Some of the more obvious difficulties can be eliminated if in the preparation of instructions it is not automatically assumed that the meaning of words, even very simple ones, is shared by the experimenter and subject. The onus is on the experimenter to provide instructions free from obscurity and ambiguity which set out the subject's duties clearly, without doing the task for him. They have to prime the subject but not manipulate him. However diligently prepared, instructions will be ineffective if the recipient does not listen to them. It is often difficult to know if failure is due to basic misunderstanding or lack of attention. Despite these difficulties, the importance of instructions is stressed and in future work, attention was paid to making instructions as clear as possible. In this connection videotapes were invaluable, since a set of instructions could be tried on a subject and the effect noted in an analysis of the tape. Following this they could be revised, re-run and, if necessary, revised again.

A special problem in giving instructions in the communication situation was that two subjects were involved. Apart from the additional excitement and obvious distraction this produced, a situation arose

where, for much of the time, the experimenter had to address himself to either the speaker or the listener when he was outlining those particular roles. Accordingly, the other child was liable to withdraw his attention, become bored and a greater source of distraction to his partner. With two children it was also more difficult for the experimenter to be sure that his instructions were understood. Another proposal, therefore, was that some tasks would be devised where the experimenter operated with single subjects, playing the role of the partner himself. Apart from providing a better environment for administering instructions and gauging their efficacy, this would enable the experimenter to play the role of the 'ideal' speaker or listener. The performance of the children could be assessed in situations where as listeners they would be given clear, adequate, but minimal descriptions, and as speakers they would have a listener who provided feedback and generally fulfilled his role.

It will be evident by now that the distinction made between understanding what is involved in a task and having the necessary skills to carry it out is a blurred one. The methods discussed above for putting across the roles involved will necessarily contribute to the skills needed to play those roles. But it is possible to distinguish two abilities which are required for successful performances.

Keeping to the type of task already used, an obvious requirement is that the subject should notice the differences between the objects or pictures used. Unless he perceives these differences and communicates them he is bound to fail as a speaker. A fairly simple experiment is proposed where the child's task is to judge whether two pictures are the same or different, and to support his judgement. No communication will be involved.

The other factor which appears to be relevant is the conservation of number. The child needs to recognise that two sets which are

adjudged equal at the start remain equivalent as long as the operation carried out on any one set is also carried out on the other. In the houses task, for example, pictures were removed from equivalent sets when they matched. Accordingly, the remaining piles of pictures remained equivalent in terms of number and identity. A task was specially devised to discover the importance of this cognitive ability in the type of situation generally used.

On the basis of the empirical data and observations made during the performances, a number of suggestions have been made concerning the factors involved in communication and some of the possible reasons for failure. This chapter will describe a series of experiments whose aim was to break down the communication task into some of its component skills. They have been referred to above as conservation, perception of differences, comprehension of instructions and an examination of the individual roles of speaker and listener. This by no means exhausts the communication task. Because it is a dynamic interaction process it resists being broken down into component parts. Many of the problems, if problems they are, are those which arise in the course of interaction between people. Differences in personality, intelligence, age, sex and home environment will all have an influence on the exchange, but it was not the purpose of this study to investigate those variables. It must suffice to say that one should be aware of them when interpreting findings.

Study I - Perception of differentiating attributes - same/different judgements

In the type of task used in the experiments described, a failure to note those attributes which distinguished one picture or object from the rest in the set, seriously affected a child's ability to communicate. To find out to what extent limitations of this sort might handicap communication behaviour, a simple pair comparison task was set up. This required subjects to judge whether two similar pictures were the same or different. Vurpillot (1968) found that very young children have no definite criteria of same and different. In a picture judgement task where eye movements were recorded, she found that their scanning was random and that their answers were unrelated to the information collected. Towards the age of five they were able to define 'sameness' as the existence of a common element and 'difference' as the absence of a common element, but their searches were not exhaustive nor did they take account of the location of attributes.

Vurpillot used presentations of houses each with six windows, the houses differing according to what appeared in the windows. These pictures were rather complex, probably to provide a sufficiently stimulating task for the upper age range of her sample which was from 3 to 9½ years of age. The pictures used in the present experiment were essentially the same as those used in the earlier 'houses' task, (Chapter 4), that is, they differed on the dimensions of colour, form and 'existence' (i.e. whether or not something was there). To gain some idea of the information on which the children were basing their decisions, and lacking Vurpillot's eye-movement recording apparatus, they were asked, following their judgements, why the pictures were the same (or different). It was hoped this would give a fair idea of the extent to which the critical attributes, vital to successful communication, were perceived by the children.

Donaldson and Wales (1970) have reported some work on the acquisition of the terms 'same' and 'different'. The findings showed that most children interpreted 'different' as they did 'same'. When asked to choose from a set of objects one that was 'different in some way' from a standard, they chose objects which were either identical or same in at least one aspect, although objects different in all respects were available. It appeared that 'same' and 'different' were being

treated as synonyms. Donaldson and Wales suggest other possible explanations which need not concern us now, but, as an attempt to overcome the difficulty, the term 'not same' has been preferred to 'different'. A study by Foubister (1971) used both 'different' and 'not same' in a classification task and reported greater evidence of understanding with the negative form.

A further innovation in the procedure was the use of a bell/buzzer device with which the child could make his judgement. Such a device had been used with the same children in a task requiring true/false judgements, and it had been found that a non-verbal means of response was particularly effective with children who were disinclined to respond verbally. Indeed once they had learned the labels attached to the bell and buzzer they seemed to acquire confidence and, somewhat paradoxically, increased verbalisation resulted. (See Donaldson, 1971). It was further hoped that the use of such apparatus would eliminate some of the ambiguity that was bound to be present in instructions concerning the notion of 'same' and 'not same'. If, by careful training, the children could learn to attach the 'ding-dong' sound to situations where objects or pictures were identical and the 'beep' sound to situations where there were one or more differences, it was believed the task would be simplified.¹ Since no systematic study of the comprehension of 'same' and 'not same' had been done, which incorporated a motor response judgement without eliminating verbalisation, it was thought the experiment might have additional benefits.

Training Programme.

Twenty-one children took part in two training sessions in which they learned to attach the label SAME to the ding-dong button and NOT

1. The use of the terms 'ding-dong' and 'beep' was not a concession to childish whims, but the only descriptions that were considered to be appropriate to the sounds produced. The terms 'bell' and 'buzzer' had already been applied to different sounds in an earlier study to denote 'right' and 'wrong'. No confusion or negative transfer seemed to result from this.

SAME to the beep button. (The buttons and bell housings for the two sounds were very different in appearance). The materials to be judged were small familiar objects, mostly toys. The NOT SAME presentations included differences of class, eg. Matchbox/Duck; colour, e.g. House with red roof/House with blue roof; form, e.g. Red jeep/Red saloon car; 'existence', e.g. Horse with rider/Horse without rider.

Since most of the children were familiar with a bell/buzzer type of apparatus it was a fairly straightforward task to train them in its use. By introducing pairs of toys with gross differences in the early trials, contrasted with identical pairs of objects, the SAME/NOT SAME dichotomy was established. In the two sessions 24 such pairs were presented, eight of which were SAME. There was a tendency to make the judgement SAME as long as there was at least one similar attribute. This was in line with the reported findings of Donaldson and Wales (1970). But all of the subjects clearly demonstrated that they had discriminated the ding-dong and beep and understood its function. Four of the younger children almost exclusively judged pairs as SAME, but as they appeared to appreciate the ding-dong/beep distinction, it seemed justified to let them take part in the experiment proper.

Method

Materials

Twelve drawings of teddy bears were used (a set of six repeated) on white card (3" square) varying in three features: red coat/blue coat, cap/top hat, stick/no stick. So as to be comparable with the houses set of pictures used in the previous study, each set was made up as follows:

- A Stick, red coat, cap
- B No stick, red coat, cap
- C No stick, red coat, top hat
- D Stick, blue coat, cap

E No stick, blue coat, cap

F No stick, blue coat, top hat

Procedure

The twelve pictures formed twenty-one pairs including six SAME (e.g. AA) and fifteen NOT SAME (e.g. AB). These were presented in a different random order for each subject, but always began with two trial presentations ('same' and 'not same') to ensure that the subject was competent with the signalling apparatus.

The instructions were as follows: 'You've seen this ding-dong and beep before, haven't you? Which is the ding-dong? Yes. Let me hear the beep. Good. Now, what do you do when I show you two things which are the same? Yes, you press the ding-dong button. And when I show you two things which are not the same, what do you do? Yes, you press the beep button'.

'Now, I am going to show you pictures of two teddy bears. Sometimes the teddies will be the same all over, sometimes they won't be the same. I want you to look very carefully and to press the ding-dong if they are the same and the beep if they are not the same'. At this point the two trial pairs were presented (later to be included in the task proper). Subjects were given guidance on these trial pairs so as to be/certain as possible that they understood the requirements of the task.

'The first two teddies I'm going to show you are not the same. What do you press? Look and see if you can tell me where they are not the same'. If the subject did not report the difference, the experimenter pointed **it** out. 'The two teddies I'm going to show you now are the same. What do you press? Look and see if you can tell me why they are the same'. The experimenter pointed out/of the identical main features which the child failed to mention. 'Now I am not going to tell you if the next teddies are the same or not the same. Look carefully and press

100

the ding-dong if they are the same, and the beep if they are not the same'. The subject then proceeded to the task proper. If after presentation, he pressed the ding-dong, the experimenter said, 'This picture and this picture are the same, are they?' This gave the child an opportunity to change his response if he wished. After a beep the experimenter said 'This picture and this picture are not the same then?' Whatever the response, the child was asked to justify his judgement, e.g. 'Can you tell me why this picture and this picture are not the same?' or more commonly 'Why?' directly after the judgement. Although only one difference is necessary to justify a NOT SAME judgement, the subject was always further asked 'Anything else not the same?' until he replied in the negative. This allowed him the opportunity to mention all the differentiating attributes which occurred to him. The study required two sessions both of which were videotaped.

Results and discussion

Subjects were scored in two main categories:

1. Making same/not same judgements
2. Perceiving and reporting differentiating attributes

The most efficient strategy for making judgements would seem to require a search along the dimensions of the picture. At first the subject would not be aware of which dimensions changed. It could be colour of coat, size of head, length of walking stick or any number of things. A systematic scanning of the pictures is therefore required, comparing each attribute in picture 1 with its corresponding feature in picture 2, and making the decision SAME or NOT SAME on the basis of this information. By this criterion a NOT SAME judgement should be reached more quickly, since it can be made as soon as one difference is found. In contrast SAME judgements demand a complete search of the pairs until the subject is satisfied there are no differences.

The above assumes that subjects will follow the hypothesised

rational or adult strategy. It is already known from the studies quoted (Donaldson and Wales, 1970, Vurpillot, 1968) that young children do not necessarily follow the adult procedure. If, despite instructions, the child was basing all judgements on similarities, then any two corresponding attributes which were perceived as identical would be sufficient for the judgement 'SAME'. Table 5-1 shows that only one subject (Paul) judged all pairs to be SAME, though two others (Jamie, Anna) were heavily biased in favour of SAME judgements.

Past findings are supported by the results of the judgement of SAME pairs. Only two subjects (Scott, Jamie) judged any identical pictures as NOT SAME and it would seem that even if young children do not have a clear understanding of the concept 'same', they seldom judge identical pictures to be different.

The rest of the analysis will be devoted primarily to NOT SAME pairs. An age difference is suggested by Table 5-1. The older children, 4 years and over (subjects 1 - 10) averaged 2.6 'misjudgements' while those under four years averaged 7.2. A Mann Whitney U Test showed that this difference was not significant. That age in itself is not a reliable guide is shown by the two youngest subjects, for example, who performed on a par with the older group.

More informative than absolute figures are the types of misjudgements which occurred and the strategies which might account for them. Under the column headed 'misjudged pairs', the picture pairs which gave rise to false¹ judgements are listed. This column is better understood if examined together with the list of picture types given in the Method Section on page . Leaving out of consideration the three subjects who seem to represent a special case - those who judged most of the pairs SAME (Paul, Jamie, Anna) - the distribution of false judgements is shown in Tables 5-2 and 5-3.

1. False only in the sense that they do not conform to the normal adult criterion of same and not-same pairs of pictures. The word 'error' may be used in the same sense.

TABLE 5-1

Same and Not-same judgements of paired
comparisons by subject

SUBJECT	AGE IN MONTHS	SAME PAIRS		NOT SAME-PAIRS		MISJUDGED PAIRS (excluding S's whose error rate is in excess of 50%)
		n = 6		n = 15		
		JUDGED SAME	JUDGED NOT-SAME	JUDGED SAME	JUDGED NOT-SAME	
1. Roddy	60	6	0	4	11	BC, DE, DF, EF
2. Alisdair	58	6	0	0	15	
3. Alison	57	6	0	1	14	AB
4. Brian	57	6	0	0	15	
5. Angela	55	6	0	2	13	AC, AD
6. Dale	52	6	0	6	9	AB, AC, BC, DE, DF, EF
7. Alan	50	6	0	0	15	
8. Lee	50	6	0	3	12	BC, BE, DE
9. Linda	48	6	0	3	12	AB, AC, DE
10. Gregor	48	6	0	6	9	AB, AC, BC, DE, DF, EF
11. Scott	47	4	2	5	10	AA, BC, BE, CE, CF, EF, FF
12. Jamie	47	4	2	13	2	
13. Margaret	45	6	0	6	9	AB, AC, BC, CD, DF, EF
14. Elizabeth	45	5**	0	6	9	AB, AC, BC, DE, DF, EF
15. Karen	42	6	0	7*	7*	AB, AC, AE, BC, DE, DF, EF
16. David	42	6	0	6	9	AB, AC, BC, DE, DF, EF
17. Nicholas	41	6	0	6	9	AC, AE, BD, BE, CE, DF
18. Paul	39	6	0	15	0	
19. Anna	38	6	0	9*	5*	
20. Christine	38	6	0	3	12	AB, BC, EF
21. Sally	37	6	0	3*	11*	AB, BE, DE
TOTAL		121	4	104	208	
MEAN		5.8	0.2	5.0	9.9	

*n = 14 **n = 5

TABLE 5-2

Number of false judgements for picture pairs
showing which critical attributes differ in each case

PAIR	FALSE JUDGEMENTS	DIFFERING ATTRIBUTES		
		STICK	COAT	HAT
AB	10	✓		
BC	10			✓
AC	10	✓		✓
DE	9	✓		
DF	8	✓		✓
EF	8			✓
BE	4		✓	
AE	2	✓	✓	
AD	1		✓	
BD	1	✓	✓	
CD	1	✓	✓	✓
CE	2		✓	✓
CF	1		✓	
AF	0	✓	✓	✓
BF	0		✓	✓
	67			

TABLE 5-3

Summary of errors as a function of attributes

	HAT	STICK	COAT
HAT	18	18	2
STICK		19	3
COAT			6
HAT & STICK			1

The Tables show that most of the false judgements concerned pairs where the stick or hat features were dissimilar. Only 12 out of 67 errors involved difference of coat colour. Taking the mean of the error scores on hat and stick features (39.5) and comparing it to the error scores on the coat attribute (12), a Wilcoxon signed-ranks test of significance was carried out. The difference was significant¹ ($n = 18$, $T = 4.5$ $p < .01$). To put it another way, most of the errors took place within two sub groups A, B & C and D, E & F which had the common attribute of the same colour coat. When there was a difference in coat colour the probability of pictures being judged SAME was .07. With this difference eliminated (i.e. same colour coat) the probability of dissimilar pairs being judged SAME increased to .39.

The result is hardly surprising. One would have predicted from an inspection of the material used that the strong colour difference between the red and blue coats would be the attribute most likely to be noticed. Apart from the colour difference itself, the area taken up by this feature is greater. In contrast the stick and hat differences of existence and form were more subtle.

The results do not discriminate between the stick and hat features. Both differences were almost equally likely to be missed. 60% of errors included^a/stick differences, and 57% involved a hat difference. 82% of false judgements occurred where 'stick' and/or 'hat' were the critical features. Cutting across this apparently clear picture is the finding that 64% of errors occurred when there was a single difference, that is, only one of 'stick', 'hat' and 'coat' was different. Table 5-3 shows, however, that the number of errors for 'stick' or 'hat' alone was three

1. Since there were more presentations of pairs with a coat difference (9) than a stick or hat difference (8), the statistical difference found is given slightly greater weight.

times the number for 'coat' (19:18:6). Therefore a single difference per se did not seem to be a significant factor.

The discussion of errors or false judgements may have obscured an important fact. The error rate for the group as a whole, taking into account only different pairs, was 33% (see Table 5-1). Thus in a task where young children have been found to have difficulty, two-thirds of their judgements were nevertheless correct. The older children did much better than this with an error rate of 17% for the four year olds, and nine children, nearly half, make three or less misjudgements out of 15. This seems to indicate that the problem for most of the children in the communication situation was not primarily one of failing to perceive differences between objects or pictures. That statement must, of course, be task specific to a large extent.

Yet, though the majority may perceive the differences, do they report them? To answer this question, vital for communication behaviour, the data on critical attributes must be examined. It has already been hypothesised that the subject searches along the dimensions of the presented pictures for similarities and differences. It may be assumed that after a number of presentations the subject will recognise that only certain attributes are critical for making the judgement; size of head, colour of trousers, etc. are irrelevant. The successful child, therefore, should restrict himself to reporting the critical attributes, namely 'stick', 'hat' and 'coat'.

It is perhaps necessary at this point to reiterate the experimental procedure. The child was asked to judge the pictures, same or not-same, and, whatever his judgement, he was then asked: 'Why are they the same/not the same?' The resulting response was always followed up with: 'Anything else the same/not the same?' Thus Table 5-4 contains data compiled from this response by the subjects. It lists the number of relevant critical attributes mentioned by each child, out of a total (possible) of 25.

TABLE 5-4

Data on reporting of critical attributes for each subject

(Not-same pairs only)

SUBJECT	AGE IN MONTHS	No. PAIRS JUDGED NOT-SAME	CRITICAL ATTRIBUTES (CA)			OTHER FEATURES
			No. PAIRS WHERE ALL CA REPORTED	RELEVANT TOTAL REPORTED	IRRELEVANT TO JUDGEMENT	
1. Roddy	60	n = 15 11	n = 15 4	n = 25 12	17	22
2. Alasdair	58	15	14	24	1	1
3. Alison	57	14	12	22	8	7
4. Brian	57	15	15	25	1	4
5. Angela	55	13	7	16	5	0
6. Dale	52	9	3	9	5	1
7. Alan	50	15	9	19	0	0
8. Lee	50	12	15	25	11	21
9. Linda	48	12	6	13	5	0
10. Gregor	48	9	9	18	6	7
11. Scott	47	10	10	19	4	9
12. Jamie	47	2	0	0	1	0
13. Margaret	45	9	0	1	1	2
14. Elizabeth	45	9	6	13	2	8
15. Karen	42	7	3	9	2	1
16. David	42	9	3	10	2	0
17. Nicholas	41	9	6	14	4	0
18. Paul	39	0	0	4	4	0
19. Anne	38	5	1	3	2	0
20. Christine	38	12	7	17	2	0
21. Sally	37	11	7	16	7	0
	T	208	146	289	90	83
	M	9.9	7.0	13.8	4.3	4.0
	%	66	46.6	55.5		

It also includes the number of pairs in which all the relevant critical attributes were reported, and the figures for irrelevant critical attributes and other features.

Some confusion may arise from the use of the terms relevant and irrelevant critical attributes. Critical attributes are the changing features in the pictures, but there will not be differences for all critical attributes in every pair of pictures to be judged. The relevant critical attributes are those which discriminate the pictures. Those which are identical in any particular paired comparison are the irrelevant critical attributes and need not be reported. A little earlier the successful child was referred to as the one who restricted himself to reporting critical attributes. Strictly speaking he would restrict himself to reporting relevant critical attributes. Table 5-4 shows how successful or otherwise subjects were.

None conformed to the strict criterion of all relevant and no irrelevant critical attributes reported. Looking briefly at the mean figures first, slightly more than half (55.5%) the total number of relevant critical attributes was reported on average, and the mean figure for the number of pairs in which all relevant critical attributes were reported was just under half (46.6%); this results from an overall mean performance of judging not same pairs (first column) of 9.9 (66%). Broadly speaking, therefore, the reporting of relevant critical attributes (55.5%) was not quite keeping pace with the number of same/not same judgements being made (66%).

To get some idea of individual performances it will be helpful, initially, to compare five children who approached the optimum performance. Their results are given in Table 5-5 for comparison purposes

TABLE 5-5

Data on report of critical attributes for selected subjects

(abstracted from Table 5-4)

SUBJECT	No. OF PAIRS JUDGED NOT SAME	PAIRS WHERE ALL ATTRIBUTES REPORTED	RELEVANT CRITICAL ATTRIBUTES REPORTED	ALL OTHER ATTRIBUTES REPORTED
Alasdair	15	14	24	2
Alison	14	12	22	15
Brian	15	15	25	5
Alan	15	9	19	0
Lee	12	15	25	33

The most striking contrast among these subjects is between Alan and Lee. Alan judged all the comparisons correctly but did not report all the relevant critical attributes and in only 9 of the 15 pairs did he report all the relevant critical attributes. In contrast Lee reported all the relevant critical attributes and accordingly achieved the maximum number of pairs with all critical features reported. In spite of this she judged 3 of the not-same pairs, same.

At first sight the implications of this for communication behaviour are that Alan will communicate inadequately although he discriminates picture differences, while Lee will communicate well despite not always making correct judgements about differences. But there is a further strong contrast between these two children. Lee reported 33 other attributes (critical and non-critical) along with the relevant features, while Alan mentioned none. The redundant information contained in Lee's reports could prove detrimental to successful communication with the 'noise' obscuring the signal. Alan appeared to have a narrower

focus of attention which was helpful to him in this task but which might prove too narrow in a communication context with critical data being left out of his messages.

From Table 5-5 we may conclude that correct judgements do not imply report of all critical features. The converse is also true: report of all critical attributes does not necessarily mean that correct judgements have been made. In support of this, the correlation between judgements and critical attributes reported for the whole group was positive but small ($r_s = +0.16$ n.s.). This figure does not reflect the general strength of the relationship because of the rather anomalous results of two subjects - Roddy and Linda. Thus inspection of Table 5-4 indicates that success in judging pairs was usually accompanied by a good score on critical attributes.

The number of irrelevant attributes mentioned seemed to follow no obvious pattern. Among the subjects listed in Table 5-5, for instance, Alison and Lee scored highly and the rest reported few extraneous features. For the group as a whole (Table 5-4) the range was considerable, from 0 to 39. The distribution was far from uniform however. Thirteen subjects reported 5 or less irrelevant features, six subjects reported between 6 and 15, and two children scored more than 30. To put this in perspective, it means that these two children included two and sometimes three irrelevant features with each justification.¹ A slightly larger group reported one irrelevant feature with most justifications, while

1. It is interesting to note the differences between these two subjects. One, Roddy, though reporting more irrelevant attributes than anybody else, failed to report more than half of the relevant critical attributes. By contrast Lee reported them all. This suggests a basic difference in their strategies - one directed, one rather aimless. In support of this Lee consistently gave critical attributes first in her justifications.

the majority of the children ignored the irrelevant features. Whether or not these scores are an index of cognitive style is a matter for conjecture. It is possible, however, that they may influence communication behaviour as mentioned above.

On the basis of the findings considered so far, including those from the training sessions, the children may be divided into four groups.

1. Those who judge all or nearly all pairs SAME (3).
2. Those who judge pairs with the gross colour difference (coat) NOT SAME, and the rest of the pairs SAME (8).
3. Those who operate close to adult criteria but sometimes miss the finer critical differences (stick and hat) and judge such pairs SAME (7).
4. Those who judge all pairs in the standard adult fashion (3).

(Figures in brackets refer to number of subjects involved).

A Discussion of individual performances.

A close analysis of the videotapes and verbal transcripts suggested a somewhat richer set of categories than those based on the group data and given at the end of the previous section. They are presented below in the form of a developmental progression.

1. Those who have a global undifferentiated understanding of same/not same, by which SAME judgements always result.
2. Those who weigh up the evidence, but for whom the attributes are differentially weighted. The strong attribute (i.e. coat colour) always gets the verdict whether SAME or NOT SAME.
3. Those who attempt to come down on the side of one or other set of attributes but remain undecided. Simultaneous judgments of same and not same often result.
4. Attributes begin to lose their differential force resulting in a shift in the meaning of 'same'. Judgments approximate

to adult criteria but subtle differences are still liable to be missed.

5. The adult criterion is reached by which any difference in corresponding attributes leads to the judgement not same.

All attributes have equal weight for this purpose.

Some examples of the stages - mainly the first three to which the majority of the children belong - will be provided below together with a general discussion of strategies used as well as other issues raised by the performances.

GROUP 1 - no differentiation of same and not same.

The first group seems to correspond to the youngest children in Vurpillot's study who seemed to be searching for similarities in a paired comparison such that any two corresponding identical features led to the judgement SAME. It is perhaps an over-strong claim to say that the children of this group interpret 'not-same' as meaning 'same' but much of their behaviour implies that this is the case. When asked, following a judgement of NOT SAME, if anything else was not the same, some children would start reporting 'same' features. Their behaviour can perhaps be understood if the relationship between the utterance to be comprehended and the concrete situation to which it refers is seen as a loose one. The child is aware when the experimenter says 'Anything else not the same?' that the question refers to features about the teddy bears since he has had his attention directed to them. The distinction between 'same' and 'not same' is probably a vague one for the younger and less able children. The fact that the term 'same' is subject to considerable ambiguity anyway, does not assist the comprehension. The children accordingly respond by naming those features which captured their attention while still conforming to the rather blurred category of same/not same. One might conclude that it is simply a case of missing the force of the negative, but the training sessions showed that if the

difference is gross enough, e.g. duck and matchbox, a not-same judgement is made. It is when same and not-same features are present concurrently that the difficulty occurs. This difficulty, in fact, seems to be present for the more advanced children and will be considered shortly.

GROUP 2 - differential weighting to attributes.

On occasions a subject will clearly state the premise for a particular conclusion but fail to draw it, for example Nicholas:

(AB) Nicholas: They have red coats. One has not a stick and one has a stick, so I think they're the same (Presses ding-dong).

E: Are they the same all over?

N: Yes.

Nicholas's behaviour is almost perverse. He implies one thing, difference, but concludes another, sameness. Gregor shows the same behaviour on a number of occasions; for instance:

(DF) Gregor: They're not the same (presses beep).

E: Why?

G: The hats (pointing at one).

E: Are the hats the same?

G: Yes.

E: Is this hat just like this hat?

G: Yes. They've got the same jacket, same trousers, same shoes. One's got a stick and one hasn't got a stick.

E: Are they **same** or not same then?

G: Them are the same (presses ding-dong).

For the pair AC, the conflicting 'evidence' is even stronger.

Gregor: Them are the same (presses ding-dong).

E: Why?

G: I don't know. Got the same trousers, same jackets.

E: Are the hats the same?

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- G: Mmm ... Yes.
- E: And the sticks?
- G: One's got a big hat on and one hasn't. One's got a stick and one hasn't.
- E: Are they same or not same?
- G: Are the same.

The justification given by a child may be regarded as the evidence on which he bases his decision. When this evidence is contradictory, as it is in the examples given above, the child is in a dilemma. Presumably he makes his choice, as would any judge, on the basis of the evidence that carries most weight. We have seen that it is usually the colour of coat that carries more weight than the other 'items' of evidence. The striking thing about many of the children is the fact that they often have the necessary facts to hand, but do not choose to use them. It may not be going too far to say that at a certain stage there is a weighing-up operation going on, possibly unconsciously, whereby 'same' and 'not-same' attributes are assigned relative values. The decision, of course, is based on what these attributes mean to the child, not on any objective criteria or adult meaning. Although in any pair of pictures there are more 'same' than 'not same' attributes, for most children the weight of an attribute like coat colour can outweigh any combination of other attributes. Thus, if coat colour is dissimilar the pictures are seen as different.

GROUP 3 - recognition of the same/not same paradox.

The difficulties of terms like 'same' and 'different' have not gone unnoticed in research into cognitive development. (Donaldson and Wales, 1970). To yield to the temptation of non-verbal methods would seem to be begging the question, since young children do use these terms in their spontaneous speech (Donaldson and Wales, 1970). It is not clear how consistently the terms are used, and their use in this experiment suggests that some

of the ambiguities which adults know to belong to the words are beginning to be reflected in child speech. They reveal themselves as conflicts sometimes explicit, more often unconscious, but nevertheless linguistically represented. An illustration is provided below.

(Pair DE)

- Lee: (Presses ding-dong) Cos that's got the same coat as that and that's got a walking stick, that one hasn't.
- E: Oh, are they the same then or not the same?
- L: They are the same, cos they've got the same coats.
- E: Yes, but is this one the same all over, as that?
- L: Well, that's got a hat the same as that. Got white there, and that one's white there.
- E: But are they the same all over?
- L: Except there and there (pointing to stick).
- E: So which one do you press?
- L: (Presses ding-dong).

And another example from the same subject.

- (BC) Lee: (Presses ding-dong). That one's got a pink coat and that one's got a pink coat.
- E: Is everything the same?
- L: Except the hats.
- E: Oh. So which one do you press?
- L: (Presses ding-dong). That one's the same as that one.

Lee seems fully aware that there are not-same attributes present in both these pairs of pictures, but refuses to be put off her original judgement. The perception of conflicting information is even more apparent in this example from Linda.

- (DF) Linda: That's the same blue (coats), that's not the same that hat.
- E: They're not the same all over, so what do you do?

L: They are the same, that (pointing at coats), but that's not the same (hats). (Presses beep).

In some instances the report of same and not-same features in one pair of pictures seems to follow directly from the experimental procedure. This would sometimes happen if, after being asked if there was 'anything' else not the same', the child gave a verbal commentary while making the search for non-matching features. In such a commentary irrelevant (in this case SAME) as well as relevant (NOT SAME) attributes might be mentioned. This explanation does not apply to the examples quoted however.

Same and not-same - the paradox made explicit.

On occasions the conflict between the competing attributes seems to be made even more explicit when the child presses both buttons or says that the pictures are same and not same. For example, David:

(BC) David: These are the same. That one has a great big one (pointing to hat) isn't it ... hasn't it ... That one hasn't.

E: Are they just the same?

D: Yes. They've both got red jackets (presses ding-dong and beep).

In another example, Christine is presented with DE.

C: They are and they're not.

E: Oh, why?

C: That one's not got a stick and that one has got a stick.

Christine seems to be saying that the pictures are alike and yet at the same time they are different (they are and they're not). She provides the reason for them being not same - only one has a stick. It is not surprising that she does not delineate the 'same' attributes. This extract comes from the end of the second session by which time she has pointed out 'same' features many times.

Two other children (Karen and Paul) press both buttons in making single judgements. It may be that the method used in this experiment was important because it allowed the children to express their level of understanding in a manner not usually possible. The contradiction which they seem to half recognise about the concept 'same' is too sophisticated to be expressed verbally, though an advanced child like Christine even manages to do this. For the others, the conflict can be expressed more naturally in a non-verbal fashion using the apparatus available. How do these children relate to those who seem to recognise a conflict but nevertheless make a decision one way or another? It may be that the paradoxical decisions - same and not-same represent a situation where a definitive decision cannot be reached. The force of both sets of attributes is equally strong and so a compromise results.

The relation between language, thought and the real world for the young child.

Although it has been known for a long time that the concrete situation has quite direct effects on the way the child thinks (Piaget 1950), it has only recently been realised how powerful is the effect of context on language (Olson, 1970; Macnamara, 1972; Clark, 1973; Donaldson and Lloyd, 1974). Sometimes the effect is very direct in that change in the concrete situation actually affects the ebb and flow, as well as the content, of language. Consider this example.

- Margaret: My Uncle Ian he's got a record.
- Experimenter: (Getting out and laying down next pair of pictures)
What did you say?
- M: My Uncle ... (speech dries up as she sees new pair of teddy pictures) Not same (presses buzzer).
- E: Why are they not the same?
- M: (Looking over to corner of room). You've got cars.

Margaret is talking about something at home but comes to a halt when something concrete is put into her visual field. She makes a judgement, whereupon the experimenter introduces some further linguistic, and therefore abstract, input. This is attenuated by the force of concrete reality once more and she talks about the cars in the corner of the room.

A slightly different example of the same general phenomenon is provided by Elizabeth. At the beginning of the session, the experimenter says 'I'm going to show you two pictures of teddy bears. Tell me why they're not the same'. Before the experimenter has time to get out the pictures Elizabeth says 'Because they're yellow'. The meaning contained in the instructions is too subtle for the child, referring as it does to a future event. As far as the child is concerned, when she is asked why something is not the case, she is required to give an answer now. The thing that springs to mind to connect 'teddy bears' and '(not) same' is their colour, yellow. She probably has an image of her own teddy bears at home. The force of the somewhat abstract 'I'm going to show you ...' referring to the future does not seem to register. David gives an instance of the same kind of behaviour, providing for the first pair of pictures a justification¹ of a judgement he has not even made, before the pictures are presented!

These examples are provided from the records of younger children. Bearing in mind other findings, it seems reasonable to assume that for children at a certain stage of development, the real world has more force than the abstract information represented in language. As Macnamara (1972) points out this is why young children generally cope well with

1. 'Because one is red and one is blue'. This is a vivid illustration of how powerful the influence of a particular perceptual feature can be.

understanding language. Adult speech to small children usually refers to events in the here and now, and the child uses the concrete information in the here and now to give meaning to the world. When language departs from the concrete and uses slightly more abstract terms, like 'all' and 'none', the interpretation is likely to break down. It is then that the child continues to use the cues available in the perceptual situation to interpret the sentence, cues which may or may not be appropriate (See Donaldson and Lloyd, 1974; Donaldson and McGarrigle, in press).

GROUPS 4 and 5 - Towards an adult criterion.

The more advanced child becomes skilled in selecting those features of a situation which carry most meaning. Olson (1970) has shown that the communication situation is particularly useful for studying the development of this behaviour. It would seem that it can also be observed in a task like the present one which involves selecting critical features over a series of picture presentations. The more able child will restrict himself to those which carry most information, and this is exactly what happens. A particularly able child like Brian, carries the process a stage further. Instead of always elaborating features in both pictures, he would sometimes say, for example 'That one's got a blue coat' - leaving unsaid that the other teddy has a red coat. One senses that he begins to realise that the situation is artificial, that the experimenter can see the difference as well as he can. For another pair judged not same (CE) he says, 'Cos one's got a red coat and one's just got a bowler hat'. This is not a clear statement, but enough for someone who only has those two pictures in front of him.

Other evidence of more advanced levels of operation includes linguistic form. For example, instead of saying 'because that one's got a little hat and that one's got a little hat', Christine used the 'superior' shortened form 'because they've both got small hats'. Another

indication provided by Lee is being able to comment on many things which attract her attention without impairing her performance. It is precisely this competition for their attention set up by extraneous objects and events which seems to impose limitations on the less advanced child.

Two unusual strategies: - absence of a common feature as a criterion for 'same' and ignoring the paired comparison procedure.

An unexpected criterion for sameness, introduced by some children, was the common absence of a feature. For example, Alison after judging CC SAME gives as one of the reasons 'Its not got any sticks'. Also Nicholas, BE, 'They have flat hats on and they don't have sticks', and Karen, BB, 'They both haven't got sticks'. The common lack of an attribute or feature is not always a good criterion for similarity. For example, neither a bar of soap nor an oak tree wear spectacles, but this is not normally considered good grounds for putting them in the same category. In certain contexts however, especially where two objects are the same by virtue of not possessing a feature common to the rest of the group, such a missing attribute can be critical.

There is a strategy which has not as yet been discussed and it is not clear where it fits in to the scheme as outlined. It involves pictures being judged independently so that the intended paired comparison is ignored. Typically, one picture is judged same and the other picture not same, not on the basis of any relationship they have with each other, but seemingly against some standard of comparison known only to the child. Some examples will elucidate the behaviour. It was at first thought that this 'strategy' was followed by only one subject, Scott, and that it was an example of a totally idiosyncratic behaviour pattern, possibly brought about by a basic misconception of the task. A careful search through the performance records, however, revealed that at least two other children were adopting the same tactic on occasions.

Nevertheless this account will draw mainly from Scott's performance. A lengthy extract from the beginning of the session indicates the origins of the behaviour.

- (AC) Scott: They're the same. One's got a big hat, one's got a wee hat. One's got a stick and the other one hasn't (Presses ding-dong).
- E: Are they the same all over? Is this just the same as this?
- S: Yes.
- E: But you said this one has a big hat and this one has a wee hat. And this one hasn't got a stick and this one does.
- S: But the same size.
- E: Yes, but you only press the ding-dong if they're the same all over ...
- S: (Uncertainly) They're the same ...
- E: If they're not the same you press the beep.
- S: One is (presses ding-dong), and the other one isn't (presses beep).
- E: Which one is the same?
- S: That one (points at picture C)
- E: And which one isn't?
- S: That one (points at picture A)

In his initial judgement Scott seems to be approaching the task in the manner of children described as belonging to group 3 (page 114), that is pointing out the different attributes yet judging **SAME**. After the experimenter points out that he has mentioned two differing features, Scott says, 'But the same size'. The significance of this remark is not clear. He does not refer to size again in the experiment and it may be that he is searching for any justification (albeit a reasonable one) for

his SAME judgement. When he is reminded of the ding-dong/beep distinction he then says that 'one is (the same) and one is not (same)'. The critical difference between this pair of pictures is the stick feature, and over the whole session this factor plays a central role in his strategy. The rule, quite simply, is that the presence of a stick means that picture is not the same; the absence of a stick means that picture is the same. So the judgement is not a comparison of the pair of pictures but a comparison of each individual picture against a standard of his own based on the presence or absence of sticks. In practice the rule operated as follows:

1. When neither picture had a stick, e.g. CF, one button pressed (SAME).
2. When one picture had a stick, and one did not have a stick, e.g. CD, then both buttons pressed - one SAME, one NOT SAME.
3. When both pictures had sticks, e.g. AA, the NOT SAME button pressed.

The stick is not the only criterion for sameness but it is always the critical one, the final arbiter when a decision has to be made. For instance he says the pair CF 'are both the same because those two haven't got the sticks'. 'Are they the same all over?' asks the experimenter. 'That coat's not the same as that coat. They're not the same all over, but they haven't got any sticks' he replies. He reaffirms his judgement of SAME.

Paul is another child who shows this behaviour, only in his case 'hat' is the critical feature. It is not clear whether it is colour of hat or merely possession of hat. It does not appear to be size of hat, however, which is the intended critical feature. This points up a difference in the strategies of these children. Scott is systematic and consistent using a clearly discriminated changing feature as his standard of comparison. There is reason to think that Paul does not

recognise any comparative meaning in the term 'same', and his judgements, 'That's the same and that's the same' or 'that's the same and that isn't the same', are stereotyped responses made in relation to an arbitrary criterion involving the hats.

The behaviour that is common to these children, and on occasions to Sally, is that of not basing their judgements on a comparison of the pictures with each other. In the case of Scott, a capable child, it is surprising how persistent this behaviour is in the face of repeated instructions to compare the pictures, i.e. 'Is this one the same as this one'.

II. Conservation of identity and equivalence over time

A piece of conceptual behaviour involved in the efficient performance of the communication tasks is the recognition that equivalent arrays remain equivalent, despite operations upon them, as long as what is done to one set is also done to the other set. For example, if $A_1 = A_2$ then $A_1 - 1 = A_2 - 1$. The worth of this simple observation in the communication task is that at any moment in time both members of the communicating dyad are aware that their partner has the same set of objects or pictures as they have. This means that a speaker can describe a member of a set sufficiently to discriminate it from the other members, in the certain knowledge that this description will also discriminate the chosen item from the listener's set of objects. Taking the simplest example, when the speaker has only one object left, he knows that the listener has only one object left and therefore no description is required since no discrimination is involved. The relevance of context for communication has already been discussed in a previous section. What is being suggested here is that, in order to make effective use of context constraints, it is first of all necessary to know that the contexts are equivalent.

Do young children retain the notion of equivalence and identity over time in spite of change and manipulation? The general area involved is conservation of number, but the type of concept in question is not the same as that traditionally tapped in number conservation experiments. It is therefore necessary to analyse the communication task in these terms to see if the precise components can be specified. The steps or processes required seem to be as follows:-

1. Match two sets (A_1 and A_2) of objects to determine equivalence. (The data obtained from the previous study would indicate that matching identical pictures is well within the capabilities of these subjects).
2. Realise that the sets remain equivalent when one set is covered by

a screen. Since object permanence is fully established at the latest by two years, this should present no problem.

3. Recognise that if an action done to Set A_1 is at the same time done to Set A_2 then the sets remain equivalent. This action might take two forms:

(a) An item is removed from each set; the two items are seen to match (see Step 1); the remaining members of the two sets are equivalent in number and identity, i.e. $A_1 - 1 = A_2 - 1$.

(b) An item is removed from each set; the items do not match.

The items are returned to the sets which are again equivalent in number and identity.

A complication is involved in step 3b since during the time the withdrawn items are being matched, the remaining sets are equivalent in number but not in identity, i.e. $A_1 - 1 = A_2 - 1$, but $A_1 - x \neq A_2 - y$. Once x and y are returned to their sets, complete equivalence is re-established.

4. Recognise that over time the successive removal of items that match will not affect the equivalence of the two sets, that is the two sets compared to each other. It is true, of course, that compared to their original state the sets are no longer equivalent.¹ They have been steadily reducing in size.
5. Recognise that, however often items which do not match are withdrawn from the sets, the sets remain equivalent as long as those items are returned to the sets. (Step 3b repeated).

1. Elkind (1967) makes a distinction between conservation of identity and equivalence. Conservation of identity involves comparison of a quantity (ball of clay) with itself after transformation (pancake of clay). Conservation of equivalence involves comparing two initially equal amounts with each other after one has been transformed. In the situation under consideration both sets are being transformed, in an identical fashion. This does not seem to fit comfortably into either of Elkind's categories, and the terms will not be used in this sense.

A search of the literature revealed no studies directly relating to the number or conservation skills involved in this type of task. Apostel, Mays, Morf and Piaget (1957) looked at the effect of screening one of two sets of objects to be compared. The children established that two rows of buttons were equal. The experimenter then covered one row with a screen and distorted that row in a typical manner (putting the buttons into clusters). The experimenter fully explained what he was doing and could be seen carrying out the operation. Because they could not actually count the buttons, however, it was found that the younger children were not prepared to accept the equality of the sets. They required that the screen be removed, so that they could count the buttons.

A study by Inhelder and Piaget (1963) required children to add beads one by one simultaneously to glasses, one wide and one narrow. This action was performed repeatedly and from time to time the conservation question was asked, concerning the equality of the number of beads in each glass. At some periods during the task both glasses were covered by a cardboard box and beads continued to be added through holes in the top. This task gave rise to unexpected conserving responses from young children, but the interesting finding for this study was that the presence of the cardboard box gave rise to uncertainty and hesitation. It could not have been that it prevented counting behaviour, since this was impossible anyway. (An alternative possibility is that it prevented the observation of one-to-one correspondence in action - P.L.) This seems to be an example of the removal of conflicting visual cues having an adverse effect.¹

1. This is in contrast to the screening studies reported by Bruner (1966). These, however, were concerned with continuous quantities where one-to-one correspondence does not apply. Pufall, Shaw and Syrdal-Lasky (1973) found that screening did not give rise to number conserving responses in a sample of children under five.

These two pieces of Genevan research suggest that in the present experiment the presence of a screen would prevent the counting behaviour and manifest one-to-one correspondence which are necessary for judgements of equality.

Research which most closely relates to the present study has been carried out by Smedslund (1966). He asked the question 'what determines the difficulty of an intellectual task?' To investigate this problem he needed a task which allowed precise prediction of level of difficulty. He used one which involved the addition and subtraction of single units to and from numerically equivalent collections. There are a number of obvious differences between Smedslund's task and that used in these studies. Whereas the objects used in this task varied within arrays, those used by Smedslund were identical both within and between collections, that is only one type of object was used, a yellow square of uniform size. The size of the collections was larger, sixteen against six, and the subjects were somewhat older, 5.4 - 6.7 against 3.3 - 4.11.

There are also a number of less obvious differences. Since Smedslund was investigating estimation of equality, subjects were asked to make judgements following every manipulation or series of manipulations. The demonstration of equivalence was only made explicit at the start of the communication task and during the matching of single items that were withdrawn. In Smedslund's experiment, there were never more than three consecutive addition/subtraction manipulations in any one trial, and judgements concerning equivalence were required after each manipulation. In contrast the arrays in the communication task underwent many changes in the course of each trial, a minimum of five, and attention was directed to the comparison of selected items rather than the remaining arrays. Because Smedslund's task was concerned with the effect of addition and subtraction on estimates of numerical equivalence, the experiment was designed accordingly. Communication behaviour was the

prime area of concern in the tasks used in this study which meant that the demands of the task were very much greater, especially in terms of information load.

Having outlined these differences, those findings that appear relevant from Smedslund will be briefly mentioned. Smedslund used additions (+) and subtractions (-) in exhaustive combinations, but the one which most nearly approximates to the current studies is what he called minus (-) symmetry. This involved taking items from both arrays (Left and Right). Judgements were noted after two operations, - Left and - Right, when the collections remained 'same', and after three operations, - L - R - L or - L - R - R, when an imbalance had been created. Unfortunately, Smedslund did not provide an age breakdown in his data since he was more concerned with comparing combinations. The - symmetry items, involving two operations only, e.g. - L - R, yielded 72% passes (N = 86, median age 5.11). The number judging both the second and third operations correctly, that is, judging 'same' after two operations and knowing which collection had more counters after three operations, was 65%, though the total percentage actually choosing the correct collections after three operations was 92%. Since this figure may include what are in fact errors of perseveration, the response pattern which chooses correctly for both operations is probably a better guide.

The evidence regarding the children's appreciation of the equivalence concept in the communication tasks is circumstantial rather than direct. We know that descriptions tend not to decrease in length in conjunction with the size of array. Earlier this was described as a failure to take account of context, and number of alternatives is a critical factor in context. It is particularly striking that descriptions do not reduce even for the last picture. On the face of it this strongly suggests that subjects do not appreciate the equivalence of

their arrays. (Those children who have no appreciation of the nature of the communication procedure, who see the task as one of describing pictures, and nothing more, will not, of course, be concerned with the equivalence of arrays).

The two meanings of equivalence have already been pointed out, number and identity. In typical conservation tasks this amounts to the same thing, since only irrelevant perceptual attributes differ. But in this task it is necessary that both players have not only the same number but the same series of items, since without this the game would become very much more difficult. This is not to say that it is necessary to know that a state of complete equivalence exists. We can be almost certain that some children are in a state of ignorance but this does not prevent them playing the game, it only affects the way they play it.

The following studies are designed to obtain a clearer picture of the young child's notion of equivalence as it appears to affect the type of communication behaviour under investigation. In line with the general methodological tenor of this research, the essential elements of the task were first given in a simplified form, followed by a second experiment in which conditions more nearly represented the standard communication task.

Experiment 1.

Materials: Two identical sets of four objects - two white toy ducks, and two green wooden beads.

Subjects: 23 children, 12 of whom were male, with ages ranging from 3 years 3 months to 4 years 11 months, mean 4.0 years.

Instruction and procedure

The experimenter and child faced each other across a low table. The experimenter put four ducks and four beads on the table mixed together. 'Do you know what these are? Yes, they are ducks and beads (balls). Good. Now put together those which are the same. (Some children needed

help, in which case a duck and a bead were placed away from the pile and apart from each other - 'Now put together all the toys which are the same as this one and put together all the toys which are the same as this one. See I've started it'.) Now I'm going to take two ducks, and you take two ducks. I'll take two beads and you take two beads'. The two arrays were lined up in one-to-one correspondence. 'Now, are my toys and your toys the same? Are these toys and these toys just the same?' When the child was satisfied that the arrays were identical, two 6 inch high wooden screens were produced. 'I'm going to put my toys behind here so that you can't see them. You put your toys behind your bit of wood so that I can't see them.' When this had been done the first of a series of 'test' questions was asked.¹

Question 1. Can you see my toys?

Question 2. Do you think that I can see your toys?

Question 3. 'Now tell me what toys you've got'.

Question 4. 'Can you tell me what toys I've got, here?'

Good. Now choose a toy and put it down here in the middle (pointing to centre of table). Now, I've got to choose one just like yours so that we have two the same'. The experimenter matched the subject's choice. 'Is this one the same as this one?' Agreed matched selections were put into a discard box which remained on view.

'Now it's my turn to choose one'. The experimenter put a toy in the middle. 'Can you pick one you've got which is the same as this one? Have you got one like this?' If the child's toy failed to match the

1. Although twelve test questions may appear to be an excessive number, it will be seen that they fitted in naturally to the sort of dialogue an adult and child might have in a game of this sort. The possible encouragement of stereotyped answers was reduced by only asking for judgements of equivalence and identity at the beginning and end of the task. This also discouraged the child from thinking that memory was involved - i.e. that he was required to remember what the experimenter had discarded and what, accordingly, remained. It could be argued that the procedure adopted by Smedslund of asking a series of questions after every manipulation alerted the child to think that changes must be taking place. At the same time the desire to follow the reasoning process very closely is recognised.

experimenter's selection:- 'Is your toy the same as my toy? Are this one and this one the same? Can you pick one that's the same as this one?' The game did not continue until the child had chosen a matching toy.

The game proceeded in this way until each player had one toy left. The toys were, of course, identical.

Question 5. How many toys have you got left?

Question 6. Can you tell me how many I've got left? (alternative form: Do you know how many I've got left?)

Question 7. What toys have you got left? (What's yours).

Question 8. What toys do you think I've got left? (Can you tell me what mine is?)

Question 9. Could it be a duck/bead* do you think? (*Experimenter provided alternative to subject's answer in question 6). If the subject yielded to suggestion he was asked, 'Is it a duck or a bead?'

The remaining toys were matched and discarded.

Question 10. How many toys have you got left?

Question 11. How many have I got left?

Question 12. How do you know I've got none/one? (depending on answer to question 9). (alternative form: Why do you think I've got none?)

The experiment was videotaped and lasted about 15 minutes.

Results and Discussion.

The answers of subjects to the test questions are summarised in Table 5-6. Discussion of this table will take a question by question approach so that it can be supplemented by extracts and observations from performance records where these are helpful.

Q.1 and 2. Can you see my toys?/Can I see yours?

These questions relate to one aspect of what Piaget calls cognitive egocentrism. The child's thinking (and perception) is said to be egocentric when he is unable to take account of another's point of view.

This has usually been tested in a literal way (Piaget and Inhelder, 1956). The child is first of all given the opportunity to walk round an object or display which appears different according to the position of regard. He is then asked to pick out from a set of pictures the one that corresponds to his own view of the object and one that represents the view that the person looking from a different position will get. Typically the egocentric child selects in both cases a picture that represents his view of the display, indicating, says Piaget, that he is unable to get outside himself and look at the world through someone else's eyes. There are a number of criticisms one can make of Piaget's position, in particular that he uses a highly complex display to investigate the procedure. Does the behaviour hold for simple objects, varying on only one or two dimensions, for example, colour? Nor does Piaget appear to control for the roles of memory and language comprehension.

The start of this experiment could be said to represent a simplified investigation of egocentric behaviour. The children were first asked for their view of the situation - could they see the experimenters toys? A couple of children were uncertain about this, at first nodding, but the ultimate reaction of all children was that they could not see the experimenter's toys. The second question asked them to put themselves in the other person's position: could he see their toys? The result here was that several of the children answered in the affirmative. When the question was repeated or rephrased three changed their response leaving four who might be said to be behaving egocentrically. At first sight it might be concluded that strong evidence had been provided to counter the notion that pre-school children are egocentric. But it would be as unwise to conclude this as it would be to assume that they were egocentric if the results had been in precisely the other direction. A more revealing approach is to consider the possible ways young children might interpret particular questions in relation to the

prevailing context. In the utterance 'Do you think I can see your toys?' the critical word is 'I', but there is no reason why the child should perceive it as the critical word. The context includes toys, screens, a table and two people. It might also be said to 'involve' the previously posed and answered question about the situation - 'Can you see my toys?' There are at least two possibilities.

1. The words 'see' and 'toys' are perceived as critical. The child can see toys and he therefore responds positively to both questions. The reason why 'see' and 'toys' influence the perception of the sentence is that the toys are the most pertinent part of his environment at that moment. He is actively spending his time looking at them and probably playing with them. For this child the pronouns 'you', 'I', 'my' carry little or no information.

2. The child may make sense of and react appropriately to question 1 and say that he cannot see the experimenter's toys. But the second question may be interpreted as 'Can you see your toys'. This question has not been asked before and is a logical follow-up to question one - 'Can you see my toys'. It was observed that those children who answered 'yes' to question 2 looked down at their array before they responded.¹

Those children who initially answered 'yes' changed their response when the question was rephrased, e.g. 'Can I see your ones behind

1. It might also be argued that 'Can I see your toys?' is rather an odd question to ask. It might even be considered an absurd question and accordingly reinterpreted - 'he must have meant can I see my toys'. This involves what Hayes (1972) calls the child's model of the experimenter, though he believes that questioning of the experimenter's intentions only occurs at a later age and that some of the results from younger children may be accounted for by a sort of blind faith in the rationality of the adults words and actions.

there?' (pointing to their arrays). This again suggests that the question as originally given was possibly seen as ambiguous but interpreted according to the demands of the context.

To sum up, the responses to questions 1 and 2 provide evidence against the egocentricity of young children, but it is suggested that this is because the notion of cognitive egocentrism is misconceived. It is more useful to consider the cognitive, perceptual and linguistic constraints operating in any given situation.

Q. 3 and 4. What toys have you got?/What toys have I got?

These questions required first of all a simple description of the toys on the table in front of the child followed by a description of the experimenter's toys. The answer to the second question was in effect a repeat of the first and assumed understanding that the sets were identical and that covering them with a screen did not affect that identity. It is no surprise that the subjects who could not accurately describe their own toys were also unable to say what toys were in the experimenter's possession. Apart from these four subjects the remainder conserved identity and equivalence when the objects were obscured from view. It cannot be ruled out that some of these subjects were only perseverating on the original response without recognising the necessity that the arrays were equivalent. It is also possible that the difference between utterance Q3 and Q4 was not discriminated.

The behaviour of the four unsuccessful subjects indicates the difficulties under which some children are under, even in very basic situations. The failure was either an inability to count up to two or not understanding the question asked, which in itself might be due to a number of factors.

Q. 5 and 6. How many have you got left/How many have I got left?

All the children were able to say, correctly, that they had only one toy left, but they were not all able to infer that the

experimenter also had one left. The subjects making this error were those who also had difficulty with other questions (see Table 5-6) apart from one child, Nicholas. He reacts to question 6 with an enquiring 'Two?' He does not appear to know that his partner in the game must have the same number of toys as himself, yet he handles all the other questions in the task very competently. Possibly he treats the question, initially, as part of a guessing game. The erroneous replies to this question all gave a figure in excess of one - either 'two' or 'three'. Assuming, for the moment that the answer 'one' indicates a correct inference, 17 out of 23 subjects (74%) recognised the numerical equality of the two sets of toys following three subtractions.

Q. 7 and 8. What have you got left?/What have I got left?

Every child was able to say, accurately, what toy he had left in front of him. They were not all able to say what the experimenter had hidden behind his screen. There is, of course, a 0.5 probability of getting the answer right by chance, though the actual proportion of correct replies was 0.78. Those in error did not completely match the error group in question 6. Two subjects (Margaret and Nicholas) who failed to conserve for number, did achieve this for identity. It may be that this is a case of perseveration, but if this is so, why did they not perseverate on question 5 and 6. It is possible that the concrete object duck or bead has more force than the more abstract number term 'one'. Of those subjects, (there were five of them) who did not give the correct answer, three were at least consistent. Their answers matched numerically those in question 6, in that they said the experimenter had a duck and a bead left, or two beads etc.

Question 9. Do you think it could be a duck/bead?

This is the only question that provides a direct challenge to the subject's response, though question 12 also represents a challenge

of sorts. Up until this point the child could answer all the questions correctly by simply describing the array in front of him either in numerical or lexical terms. There was no need to be aware of the necessary equivalence of the two arrays. It could be argued that if the answer to question 8 is simply a result of repeating the answer to question 7 (perseveration) or of guessing, then a challenge to that answer would cause the child to change his answer to that of the alternative toy.

Three basic response patterns emerged.

- (i) Those who stood firm, and denied the possibility that the experimenter could have anything other than the toy they said he had (represented by a tick in Table 5-6).
- (ii) Those who yielded to the suggestion that the experimenter might have the other toy, but when given a chance to confirm their original choice, i.e. 'duck or bead', did so. (A zero in Table 5-6).
- (iii) Those who yielded to the experimenter's suggestion and then adhered to this alternative choice. (Cross in Table 5-6).

The respective numbers of ticks, zeros and crosses were 8:10:2, three subjects making no meaningful response. The majority of subjects did therefore waver in the face of uncertainty, indicating that their earlier responses had not been entirely confident. Their replies varied from 'Maybe' to 'Yes' and head nodding. In contrast those in the first category above answered 'No' confidently, often accompanied by a smile. Of those who were tempted to consider another possibility, only two finally accepted the alternative. Whether this means that on reflection they realised the logical necessity of their original choice or that they simply favoured their original guess, it is not possible to say.

Q. 10 and 11. How many have you got left?/How many have I got left?

The response patterns for these questions mirrored those for

questions 5 and 6. Apart from Nicholas and Karen (who said she had two left) it was the same subjects providing irregular responses. As before they were correctly able to assess their own situation (apart from the exception quoted), but believed that it was not equivalent to that of the experimenter. He was thought to have ducks and/or beads remaining behind his screen. They maintained this despite all discards being in full view in a box on the table. 70% gave a conserving response.

Question 12. How do you know I've got none/one etc?

Eight subjects declined to say anything when asked for a justification of their answer to question 11. These are omitted from Table 5-7 which gives the answer of the remaining subjects to this question.

TABLE 5-7

Individual answers to test question 12

<u>SUBJECT</u>	<u>JUSTIFICATION</u>
Roddy	'Cos I haven't
Alasdair	'Cos you have ... 'cos I know you haven't (lifting up his screen)
<u>E</u> : How do you know? 'Cos I know - I just know	
Brian	'Cos they're all in the box
Angela	'Cos all the ducks and balls are in the box
John	'Cos they are (four)
Alan	'Cos you haven't
Lee	'Cos you had two and I had two. <u>E</u> : So why do you think I've got none? (lifting up her screen) 'Cos see, I've got none
Linda	Because you've put them away (looking at discard box) you've put all away
Scott	'Cos we've all finished them
Sylvia	Because I do
Gregor	Don't know
Nicholas	Well, you don't have any (question repeated) Because you sold them all
Christine	Because you haven't ... Because you have, that's why ... Because there's none on the board
Anna	(After three repeats of question) Can't remember
Sally	(After series of repeats and no responses) I've not got any ...

It is seldom easy to interpret the justifications of pre-schoolers

engaged in tasks involving a logical concept. On the face of it Lee's response 'Cos see, I've got none' and those of Roddy and Sally (see Table 5-7) indicate that they are making an inference. They are comparing their situation with the experimenter's and drawing the appropriate conclusion. Since, however, that inference is not explicit it is not possible to rule out a misinterpretation of the question. They may have taken it to be 'How do you know you've got none left?' This criticism is unlikely to apply to Lee, who first of all pointed out the initial equality of the two situations, usually regarded as one ingredient of a conservation response.

Another group of subjects made some reference to a change in the perceptual situation, i.e. Brian, Angela, Linda, Scott and Nicholas. The answers were not equally sophisticated - compare Brian's 'Cos they're all in the box' with Nicholas's 'Because you sold them all' - but they all seem to show that there has been a transfer of toys from one place to another. It is also significant that most of these answers use the word 'all'.

Another category of answer can be distinguished - the 'Because ...' category. This was very often tautological: 'You have none left because you haven't got any' - (Alan, Christine). It was represented in its simplest form by Sylvia: 'Because I do'. Such answers would not normally be regarded as evidence of the concept of equivalence and identity. The answer given by Alasdair probably would: 'Cos I know you haven't. I just know'. The answer does not look very different from that of Sylvia. It is the committed nature of the response that distinguished it - 'I just know'. When the experiment was over he walked round the table and looked behind the experimenter's screen and said, 'I thought you had nothing ...'. Piaget regards the use of the word 'must' as indicating awareness of logical necessity. Alasdair seems to be near to this, but it must be admitted that there are no solid grounds for believing that Sylvia

is not equally aware of this necessity.

The conclusion seems to be that none of the justifications unequivocally indicates that the child recognises the logical necessity of the equivalence of the sets, though a number give empirical evidence to support their answers. The difficulty with logical necessity is that when it is self-evident there seems to be no need to say so. On being asked for a justification, the most natural reaction is to provide empirical support for an answer.

This question proved the most demanding and only two of the subjects below the age of 3.9 showed any indication of being able to cope with it.

Summary of findings.

1. A majority of the three and four year old subjects, more than 70% - well above chance level - dealt with test questions in a manner which suggested an understanding of equivalence and identity.
2. An equally consistent minority, about 25%, failed to show any appreciation of the problem.
3. The study did not support the notion of egocentrism, but it was pointed out that this was partly due to the use of unsatisfactory blanket terminology in the past.
4. The design of the preliminary study did not rule out the possibility that subjects were 'reading-off' from their own arrays, instead of inferring on the basis of logical equivalence, when pronouncing on an unseen situation.
5. Two questions attempted to control for this, and, though some children reversed their decision, an overall majority of subjects maintained their position when challenged or when asked to justify it.
6. A consideration of these findings in relation to those of others, e.g. Smedslund (1966), will follow the presentation of the second experiment.

Experiment 2.

An errorless performance in Experiment 1 cannot be taken as conclusive evidence of identity and equivalence conservation. The same result would be achieved if the subject merely described what was in front of him in answer to questions. He could even have seen the game as one of echoic repetition. Notwithstanding the effect of a challenging statement by the experimenter (Q.9, Exp. 1) a more rigorous test was considered necessary. This would be provided if the experimenter made a deliberate error towards the end of the session. If the experimenter's choice did not match that of the subject's, it would leave the two participants with remaining arrays that were also different. If the child was able to say what shape or shapes his partner had left, the 'reading-off' strategy could be eliminated. However, an error in this situation would not necessarily mean that success in Experiment 1 was based on simple repetition of own array, since the inference involved in Experiment 2 may be more complex than that in the first experiment. The basic problem is represented in symbolic form below.

Experiment 1	$x_1 + y_1$	$=$	$x_2 + y_2$
	$(x_1 + y_1) - y_1$	$=$	$(x_2 + y_2) - y_2$
therefore	x_1	$=$	x_2
Experiment 2	$x_1 + y_1$	$=$	$x_2 + y_2$
	$(x_1 + y_1) - y_1$	\neq	$(x_2 + y_2) - x_2$
therefore	x_1	\neq	y_2

The second experiment sought to **simulate** the standard communication task and to this end a larger array of items was used varying on three dimensions.

Method

Subjects: 15 of those who took part in experiment 1. (Five were eliminated from the original pool on the basis of their performance - those who failed to show **any appreciation of the problem** - and three were

absent due to illness.) The age range was 3.3 to 4.11.

Material: Two sets of hard plastic geometric shapes varying on three dimensions - form, size and colour - as follows: Big red square, little red square, big white square, little white square, big red circle, little red circle.

Procedure: The instructions and general procedure followed those of Experiment 1. Test questions were only introduced at the point where each participant had two shapes left. At this point it was the child's turn to select and place a shape in the centre of the table, first. The experimenter deliberately created a mis-match by choosing the non-identical shape. The experimenter asked if the shapes were the same, though in practice most subjects spontaneously remarked on the difference. Test questions then followed.

Question 1: How many have you got left?

Question 2: How many have I got left?

Question 3: What have you got left?

Question 4: What have I got left?

Question 5: How do you know?

The experimenter then changed his shape to create a match. He then asked:

Question 6: What have you got left?

Question 7: What have I got left?

After all the shapes had been discarded the experimenter asked:

Question 8: How many shapes have you got left?

Question 9: Do you know how many shapes I have got left?

Question 10: How do you know I've got none/one etc?

The sessions were videotaped and lasted about 15 minutes.

Results and Discussion.

Table 5-8 contains the basic data. The test questions will again be considered individually.

Q.1 and 2. How many have you got left?/How many have I got left?

These questions were generally handled well, though the subjects who made errors had previously indicated no difficulty in Experiment 1. To be specific, all subjects answered question 1 competently, but the five children at the bottom end of the age range were incorrect in saying how many shapes the experimenter had (Q.2). Four of these five said that the experimenter had none left, and this was also the answer given by Brian, an older and more advanced child, when this part of the experiment was repeated. The cause of the problem would seem to be that the mismatch has taken place. It may be, for instance, that they assume that their partner has none left since he has failed to match their shape. He has always done this in the past and they infer that his failure to do so must be because he does not have that shape left. This is a fairly sophisticated (if fallacious) inference however, and a simpler explanation may be nearer the truth, that is that they are confused and absorbed by the mismatch and do not give the question their full attention. The answer 'none', therefore, if not entirely arbitrary, is nevertheless unconsidered. It may be that both explanations help to account for this behaviour, in that the children are partly led into thinking the experimenter has used all his counters because their attention is captured by the mismatch situation. These speculations are given some support by the reactions of these children to question 4. If they were being consistent they should also reply 'Nothing' or 'None' to the question, 'What have I got left?' This was in fact what happened suggesting that the 'failure to match-means-not able to match-because-no other shapes' inference does play some part in the explanation.

Q.3 and 4. What have you got?/What have I got?

Only one child (Elizabeth) was unable to describe her remaining shape accurately; otherwise question 3 presented no problems. Question 4 was a critical test of the 'reading-off' hypothesis and showed whether

or not children could make the appropriate deductions and continue to conserve identity after a deliberate mismatch had been introduced. Table 5-8 shows that most of the children fail to transcend the conflict which has been set up. A breakdown of the type of responses emanating is given in Table 5-9.

TABLE 5-9. Response categories for question 4 - What shape do subjects think E has remaining after mismatch?

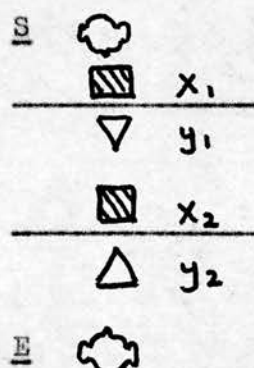


Illustration of the type of situation prevailing when question 4 is asked.

Response Pattern	Subjects
I E has same behind screen as they have in middle of table (i.e. $\Delta : \Delta$)	Angela Alasdair (2) Lee (?)
II E has something other than they have left (e.g. $O : \Delta$)	Alison Brian (1)
III E has same behind screen as they have behind screen (i.e. $\square : \Delta$)	Roddy Sylvia Alasdair (1) Elizabeth Alan Nicholas Scott
IV E has nothing left ($- : \Delta$)	Brian (2) Sally Gregor Christine
V Don't know	Linda

We have already^d dealt with the children who respond with 'Nothing', category IV.

The response pattern labelled III is one that was successful in Experiment 1 when behind-screen shapes always did match. Seven children react in this way which throws into doubt the idea that earlier responses were due to the logical recognition that they must be the same. The 'reading-off' hypothesis or one of its variants assumes greater relevance as an explanation for the behaviour of these children.

The appropriate response pattern, I, seems to include three children, though the degree of confidence with which recognition of identity conservation can be assumed, varies. Angela appears to provide good grounds. In the following extract, after mismatch, Angela has a white square left, and E a red circle.

E: What have you got left?

A: A square

E: What have I got left?

A: Round

E: What colour is yours?

A: White

E: What colour is mine?

A: Red

E: I've got a red round one have I?

A: (Nods)

E: And you've got a white square?

A: (Nods)

E: How do you know I have?

A: (Appears to reflect. No response)

E: Why do you think mine is red and round and yours is white and square?

A: 'Cos you've used all the others

She clearly identifies the experimenter's remaining item. The justification, though adequate as far as it goes, seems to imply that a calculation involving the elimination of items used will provide the answer as to which one remains. If this is a correct assumption it further implies the existence of a reasonably efficient memory store.

It is not evident that she appreciates the necessary implications of the situation in the diagram accompanying Table 5-9. In symbolic terms:

<u>Her</u>	<u>E</u>
$x_1 : y_1$	$x_2 \cdot y_2$
y_1	x_2
$\therefore x_1$	$\therefore y_2$

Alasdair is given two attempts at the problem. On the first occasion he responds after pattern III. When the problem is represented, i.e. the experimenter again fails to match his choice, the verbal exchange is as follows:

- E: What have you got there?
- A: I've got a square (showing it)
- E: Do you know what I've got here?
- A: Square
- E: What sort of ...
- A: A round one
- E: A round square?
- A: No
- E: What have I got?
- A: A round shape (correct)
- E: What colour?
- A: Red (correct)

trial

When asked for a justification after the first¹, he said 'Cos I know'. Unfortunately a justification was not recorded after the

second trial. It does seem that Alasdair has profited by his earlier experience and he may now realise that if $y_1 \neq x_2$, then $x_1 \neq y_2$ and he may further conclude that if y_1 implies x_2 then x_1 implies y_2 . On the basis of the evidence it is not possible to say that Alasdair appreciates the logical relationship involved.

Lee is the other child who gives an indication of recognising the problem.

E: What's yours? Which one have you got left?

L: I've got a big white one

E: What have I got left, here?

L: Mm. (looks down at her array, then across at discard box).

That one (points to her shape in the middle of the table -
i.e. the correct shape).

This seems to be a clear-cut example of a subject recognising and making allowances for the mismatch and deducing that her shape in the middle must match the experimenter's remaining hidden shape. Unfortunately, the dialogue continued as follows:

E: Is that the one I've got here, is it?

L: (Nods)

E: How do you know that?

L: Cos ... you've got the same as me left

E: What have you got there?

L: (Holds up big white square)

E: Have I got that left, here?

L: (Nods)

This behaviour seems to weaken the case made out earlier as she appears to return to the familiar position of assuming that the experimenter has left what she has left. It could be, however, that her justification 'You've got the same as me left' refers to the total situation and not just the area behind the screens. If this is correct,

then it must be assumed that the experimenter's later question, 'Have I got that left, here?', meaning the child's behind-screen shape behind his screen, is taken to mean something else by the child, that is 'here' is taken to refer to the middle of the table. The exchange continues with the experimenter repeating the question.

E: What have I got left here? (indicating behind screen)

L: (Ignores question). Well, take that away (removes her red circle) and that will be the same (replacing it with her big white square)

(The matching shapes in the centre are put in the discard box).

E: What have I got left here?

L: I've got left this? (showing her red circle)

E: Tell me what I've got left here?

L: A wee round

E: (E removes his screen)

L: See, I told you

Lee does not answer the critical question when it is posed again, so the above explanation must once again be somewhat speculative. It is at least clear that she sees that a different situation has been created and that this might have relevance to other pieces in the 'jigsaw'. The need to remedy a mismatch situation, demonstrated when Lee exchanged her shapes, is one shown by a number of other subjects, who do not otherwise make the appropriate deduction.

Those children in Category II who do not equate the experimenter's hidden shape with their selected shape, and yet do not conform to pattern III, may represent a transitional point. They know that the experimenter has not the same as they have concealed, because his shape that corresponds to their 'behind-screen' shape is in the middle of the table (it cannot be in two places at once - which is in fact the implication that follows from category III responses). At the same

time these subjects fail to complete the other half of the solution, namely that what they have in the middle of the table is the same as the shape behind the experimenter's screen. Because of this they offer other possibilities, shapes which have already been discarded or, in Linda's case, the response is 'Don't know'. The following example is taken from Alison's record:

E: What have you got left?

A: A square

E: What have I got left?

A: A round (correct)

E: Is it a big one or a wee one?

A: A big one (wrong)

E: What colour is it?

A: Maybe it's a wee one (correct)

E: What colour is it?

A: Maybe white (wrong)

E: What have I got left here do you think?

A: I don't know

E: (Exchanges his shapes to give match in the centre)

A: Yes, you did have a round.

Alison has definitely gone beyond the stage of simply equating her remaining shapes with the experimenter's, regardless of what selections are made. She is in fact quite near a correct response, but it can be seen that the strategy she employs is not based on logical deduction, but a more or less random procedure, and she is eventually obliged to admit that she does not know. When Brian, who also falls into this category, is asked what shape the experimenter has left, he furrows his brow and puts his head down almost like Rodin's Thinker as if searching his memory. His eventual response refers to a shape already discarded.

In summary it is possible to define a number of response patterns which might be said to represent three levels of behaviour.

1. Those who recognise the implications of the mismatch, that it must of necessity mean that the two collections have an inverse rather than a simple one-to-one correspondence. Three subjects seem to be at least candidates for this level.
2. Those who appear to have some understanding of the situation in that they do not regard the concealed shapes as identical. They are not able however, to carry through the implications of their inference. Three subjects belong in this category.
3. Those who believe the residual shapes are the same although there is evidence before their eyes which denies this. They fail to recognise the conceptual problem involved. Six subjects are clearly at this level.

Q.6, 7, 8, 9.

The remaining test questions will be dealt with briefly since they were only included for completeness, and a number of the children were disinclined to answer them. This seemed to be partly due to the energies expended during the mismatch situation - some children were questioned quite intensively - and partly due to a failure to maintain attention generally.

Almost without exception, those subjects who did respond coped competently with the questions concerning identity after the mismatch was eliminated (questions 6 and 7), and with those concerning number when all shapes had been used (questions 8 and 9). Of those subjects who were prepared to give justifications (question 10), some appealed to their own situation, e.g. Alison: 'Because I've got none left', others to the general situation, e.g. Brian: 'Because they're all in that box', Scott: 'Cos I do. We've finished them', and others to a personal intuition, e.g. Christine: 'Because you have'. These responses were

very similar to those made in Experiment 1 and the remarks made then apply here.

General Discussion and Conclusion

The realisation that equivalent collections remain the same compared to each other, as long as anything done to one collection is done to the other, was thought to be a considerable aid to efficient communication in the present programme of studies. The investigation carried out has shown that the appreciation of equivalence over time and through withdrawals is present as long as the things done to each collection are seen to be equivalent, i.e. that withdrawn items match. It has also been shown that even when they are not seen to be equivalent (i.e. $A_1 - x$, $A_2 - y$) conservation of number appears to be maintained. A simple strategy of repeating or reading-off a description of the subject's own array could have accounted for these results. When a deliberate mismatch was perpetrated and arrays were no longer equivalent in terms of identity, only a small minority of subjects were able to make an accurate deduction.

It will be noted that in the latter case the original premise has not been fulfilled - 'as long as anything done to one collection is done to another'. In order to determine the validity of the reading-off hypothesis it became necessary to alter the rules of the game. The notion of logical identity was still the key factor but an additional element was involved.

What do these findings contribute to our knowledge of ⁿconservation behaviour and what is their relevance for the communication studies? As regards conservation, it is difficult to relate the current findings to previous work since other studies have dealt exclusively with number by ensuring that identity within sets was uniform, for example the studies by Smedslund (1966). Smedslund's youngest subjects were older than the oldest subjects in the present task, nevertheless those

achieving number equivalence in Experiment 2, after five subtractions and a mismatch, were 73% of the total sample. It should be emphasised that true number conservation was not being measured here since the standard conservation question was not asked. Only in the case of identity, for instance, was the subject's answer challenged. Thus 'reading-off' might still be the explanation for conserving number.

The adverse effect of screening items to be conserved, reported by Apostel et al (1957) and Inhelder and Piaget (1963) was not observed in this study as far as number equivalence was concerned. It may be assumed, however, that the removal of screens would have facilitated identity recognition which was upset by the mismatch situation.

Evidently subjects do not need to see and be able to count the other collection to know that the number in each set is the same. When the questions are asked the size of the arrays are, of course, minimal - one in each - but this has reduced from six without the subject actually observing the effect on the size of the other collection. If this ability to conserve number over time, which also survives challenge and mismatch, is not simply a reading-off process then it is an impressive accomplishment for children of three and four years of age.

Since this work was carried out a series of studies by Schaeffer, Eggleston and Scott (in press) have been reported tracing the development of number in young children. An impressive body of work is presented but little seems to have direct relevance for the concepts under investigation.

It is reported, however, that the cardinality rule is not acquired until what they call stage 3, average age 4.2 years. This was measured by a procedure which first required the children to count aloud a collection of poker chips, then say how many were present and then say again how many were present after the chips were covered up.

Possession of the cardinality rule does not imply conservation however. Greco and Morf (1962) showed that number name or 'quotité', the cardinality rule, is correctly applied before conservation of amount, or 'quantité'. The child may say that two sets both contain 6 items even though they differ in visual extent, yet deny that they contain the same number of items. It would appear that one-to-one correspondence is still required, an opportunity denied to subjects in the present experiments. In another recent study Gelman (1972) has shown that when number estimation difficulties are eliminated, by using arrays of two and three objects, children as young as three see number as invariant under irrelevant transformations. Since one of these transformations involved addition and subtraction the finding is of some interest. At the same time Gelman's young subjects failed the traditional Piagetian conservation task even using small arrays. Gelman uses these two pieces of evidence to support the argument that the traditional Piagetian conservation task measures more than logical capacity. It is 'at a minimum, a test for logical capacity, the control of attention, correct semantics and estimation skills' (Gelman 1972).

In the current studies it was concluded that recognition of number equivalence rather than true conservation was present, since adequate conservation measures had not been taken. As in Gelman's experiments small numbers were involved and it seems that this study supports Gelman's claims that an understanding of number *invariance* is present among very young children. An extra dimension has been added in this study in that the recognition survives the further transformation of a hidden comparison array.

Given that the evidence regarding recognition of number equivalence is not conclusive, there is little doubt that the notion of identity is not well established and may give way in the face of challenge or a mismatch situation. This would be in line with

communication findings that length of description does not decrease along with the size of the array. It could be argued that the demands of the communication task are so great that a description of a rather complex picture (e.g. the houses) was sufficient information load for the subject. Given a less complex stimulus, length of message might have decreased. Unfortunately it is difficult to measure a significant decrease in length of message unless the items to be described are sufficiently complex. There must be enough critical attributes for some to decline in importance along with group size. An attempt is made to come to terms with this problem in the next study. The set of geometric shapes, used in Experiment 2, may be regarded as a compromise between very simple objects requiring one word descriptions for discrimination (duck/bead) and the more complex houses pictures. As well as possessing three varying attributes, the houses had a number of redundant features which, it was seen, were often more powerful captors of attention. Accordingly, an additional interest in the next study to be reported was to see if length of descriptions would decrease when material such as the geometric shapes was used, which still varied on three dimensions but was otherwise devoid of redundant information.

III - The effect of an 'ideal' listener on the performance of the child as speaker.

In their studies of communication Glucksberg and Krauss (1967) suggest that it is because they encode messages in a non-social fashion that pre-school children are unresponsive to feedback from the listener concerning message adequacy. An equally plausible reason is that the feedback itself is inadequate. The evidence from the present studies is that the children have not functioned well as listeners.

Glucksberg and Krauss (1967) studied the effect of feedback on a speaker's subsequent message, the adult experimenter supplying the feedback. This was in the form: "I don't understand which one you mean; tell me more about it!" They found that their youngest subjects, of kindergarten age, were unable to provide a new description, but 60% of them were able to modify their previous description on at least one occasion (my underlining). As the authors do not provide any other relevant information in their results it is difficult to know precisely what this figure means. It has been mentioned before that the type of stimulus material used by Glucksberg and Krauss, ambiguous drawings sometimes called 'squiggles', is unsuitable for investigating communication skills in pre-school children. The theoretical position of these workers suggests that they consider feedback to be ineffectual for children of nursery age, but since they did not include three and four year olds in their sample, the hypothesis needs to be tested.

There are other factors which require that the performance of the children as speakers with an adult listener be investigated. A concern for instructions has already been expressed. In the communication tasks which have been considered thus far, with one exception the experimenter has been giving instructions to two children. It is a distinct possibility that some confusion is possible, however carefully planned, when separate roles are being outlined for different children who are both

present. With the adult experimenter as the ideal listener this difficulty is eliminated.

The main weakness of speakers in the past has been a failure to include critical attributes in their descriptions. It is argued that an ideal listener might be able to direct the speaker's attention to critical attributes by simply indicating when a message is insufficient. Up to now the listening children have not told their partners when they have been unable to make a certain choice, which necessarily leaves open the question of whether the speakers could have reacted to feedback if they had received it. The ideal listener, who is ideal only in the sense that he will always provide feedback when it is useful, will have a measure of control over his part in the task. He can influence the extent of the inference demanded of the speaker, by varying the amount of information in his own message. For instance, if the speaker's message was 'It's a car' and the listener had two cars in his array, a big one and a small one, his alternative retorts might be:

(1) I've got two cars

(2) Which one do you mean, the big or the little one?

The first feedback may alert the speaker to the fact that the listener is in a dilemma. He has two cars and he doesn't know which one to choose. The speaker may go on to infer that determination of size would resolve this dilemma. In the other alternative, the problem is made quite explicit and no inference is required of the speaker. He simply has to say which size of car he intended. Some illustrations of procedures to be followed by the ideal speaker are given in the Method section which follows.

A minor adjustment to the task situation was the introduction of small 'trays' divided into six compartments to take each of the six items in the array to be described. It was thought that this would help direct the child's attention during the initial instructions when he

was asked to pick out one object and tell his partner which one it was.

Method.

Subjects

14 children, with equal sex distribution and ages ranging from 3 years 4 months to 4 years 8 months, mean age 4 years.

Material. As for Study II:

Two equivalent sets of six plastic geometric shapes: Large red square, small red square, large white square, small white square, large red circle, small red circle. Two 6" high boards to screen arrays. Two 20" x 4" trays divided into six compartments to accommodate the shapes.

Procedure

The subject was first of all asked to name one set of shapes and, with the experimenter sitting beside him, was told to put his shapes into the tray provided. He was asked to pick a shape from the tray and put it out in front on its own and tell the experimenter about it. This was done twice, with the experimenter making no comments about the child's descriptions, to make sure that the child was clear about the basic nature of the task.

The experimenter then sat opposite the child and another set of shapes was produced. The child was invited to match them. When he was satisfied that the two arrays were identical, they were placed in the respective trays and concealed by screens. Instructions were then as follows:

'Now I can't see your shapes. Choose one of your shapes but don't show me. Just put ypur finger on it and tell me which one you have chosen so that I can choose the same one from my shapes'. If the child's description was adequate, the experimenter selected the corresponding shape and held out his clenched fist so that the child did not see and was not influenced by the experimenter's choice. 'This is the one I

think you told me about. Now, show me the one you picked. Put it on the table'. The two were placed side by side on the table. 'Are they the same? Is this one the same as this one?' If they matched they were placed in a discard box which remained in full view throughout the task. If they did not match, the child was asked, 'Why are they not the same?' If he did not know or his answer was unsatisfactory, the differences were pointed out and the shapes returned to respective arrays. The child was asked to choose again.

When the child's first message was inadequate, the experimenter replied according to a format which successively supplied the speaker with more information, until finally he was required simply to 'choose' between two alternatives. If the feedback at any one stage failed to produce an appropriate reaction, the listener proceeded to the next stage. The format was as follows:

1. Repeat message to see if hearing it again causes the child to notice its inadequacy and modify it accordingly.
2. Expand the message to indicate the listener's dilemma, implying that he has more than one item that fits the description.
3. List the shapes which fit the description.
4. Ask for a direct description.

The two examples given below indicate responses that might be given under procedures 2, 3 and 4.

Child Speaker's Message

A square

Ideal Listener's Response

2. I have four squares.
3. I have a wee red square, a wee white square, a big red square and a big white square.
4. Which one do you mean? Is it red or white? Is it big or wee?

A big one

2. I have three big ones.
3. I have a big red square, a big white square and a big circle.
4. Which one do you mean. Is it a square or a circle? Is it red or white?

When the child had modified his description sufficiently for the experimenter to make a choice the procedure continued as already described with the shapes being matched. If the child failed to provide an adequate description even after stage 4 of the feedback format, the experimenter chose a different shape from the speaker's, and the procedure already described when items did not match, ensued.

The experiment involved two blocks of trials in which all the shapes were worked through on each occasion. The session was videotaped and lasted twenty minutes at the most.

Results and Discussion.

One subject declined to take part in the second block of trials and therefore her scores are not included in the group data presented, though her performance record can be found in the appendices (A & B).

There are three measures of successful communication on the part of the speaker.

- 1) The ability to select and report the critical attributes which enable successful discrimination by the listener.
- 2) The ability to ignore the irrelevant or redundant information.
- 3) The ability to modify the message, as a function of the listener's feedback, if it has been inadequate.

1. Selection of critical attributes

Success in this sense means that the speaker includes the critical attributes in his first message, that is, it must be independent of any

aid from the listener.¹ The comprehensive subject by subject data will be found in Appendix A, while Table 5-10 summarises performances in terms of number of descriptions. The 13 subjects provided a total of 132 trials.² Table 5-10 shows that 61 of those trials were completed with one description, that is, the information contained in them enabled the listener to choose the correct shape without needing to ask for further information. Since the Table also shows that there were 274 descriptions in all, this means that the remaining 71 trials required a total of 213 messages before successful discrimination was achieved.

Figure 5-1 gives a breakdown in histogram form of the relationship between trials and number of descriptions. The 61 trials (46%) that were completed after only one description appear as the first block. Another 27% were discriminated after two messages and the remainder were distributed more or less evenly between 3, 4 and 5- plus descriptions. Since the listener was providing additional feedback on each occasion the type of assistance provided after two, three or four inadequate messages from the speaker did not seem to be significantly different in effectiveness. This distribution suggests that mere intimation of the

-
1. Strictly speaking it is impossible to rule out aid from the listener, except perhaps for the first message of the first choice shape. Subsequent to this the listener has an opportunity to play a part. Although on any one selection the speaker's first message is independent of listener participation, help derived from earlier feedback, concerning other shapes, may assist the speaker's performance.
 2. A trial represents the speakers attempt to describe one shape selected from the array of six. Five of the trials were meaningful in the sense that when one shape remains no description is necessary. The subjects performed the task twice, giving a total of $13 \times 10 = 130$ trials. The extra 2 trials are due to 2 subjects giving descriptions which led to a wrong choice by the listener, so necessitating two extra trials.

TABLE 5-10

Performance of children as speakers showing total number
of descriptions given and number of trials completed in
one description

SUBJECT	AGE IN MONTHS	TOTAL NO. OF DESCRIPTIONS			No. OF SINGLE DESCRIPTION TRIALS (i.e. without feedback)		
		BLOCKS (n=10)	T (n=10)		BLOCK (n=10)	T (n=10)	
		1	2		1	2	
Alan	56	10	6	16	2	4	6
Lee	55	6	6	12	4	4	8
Scott	52	16	9	25	1	2	3
Jamie	49	17	14	31	1	3	4
Gregor	50	12	19	30	2	2	4
Elizabeth	47	9	8	17	2	4	6
Nicholas	46	12	8	20	0	2	2
Karen	44	7	11	18	3	3	6
David	44	13	13	26	0	1	1
Sally	42	6	8	14	4	2	6
Clare	42	11	6	17	2	4	6
Paul	41	16	12	28	1	3	4
Christine	40	9	11	20	3	2	5
		144	130	274	25	36	61

listener's inability to make a selection was enough to alert half of those subjects who did not achieve first time adequacy. But those who did not 'catch-on' then, seemed to need fairly explicit feedback from their partner. A fuller discussion of success rate as a function of feedback type is given below (see Table 5-12)

Looking at the subject **by** subject results, (see Table 5-10) if it is accepted that three or more single-description trials out of five represents a fair degree of competence, the data show that eight

subjects fall into this category (Alan, Lee, Elizabeth, Karen, Sally, Clare, Paul, Christine). Two of them (Lee, Karen) achieve this in both task performances. Lee comes closest to producing a 'perfect' performance with 8/10 trials being adequate after 1 description, and the other two requiring only 2 descriptions. Table 5-11 shows that number of descriptions reduces as a function of the number of alternatives..

Fig. 5-1 Number of Descriptions per trial - absolute totals and as a percentage proportion of the total

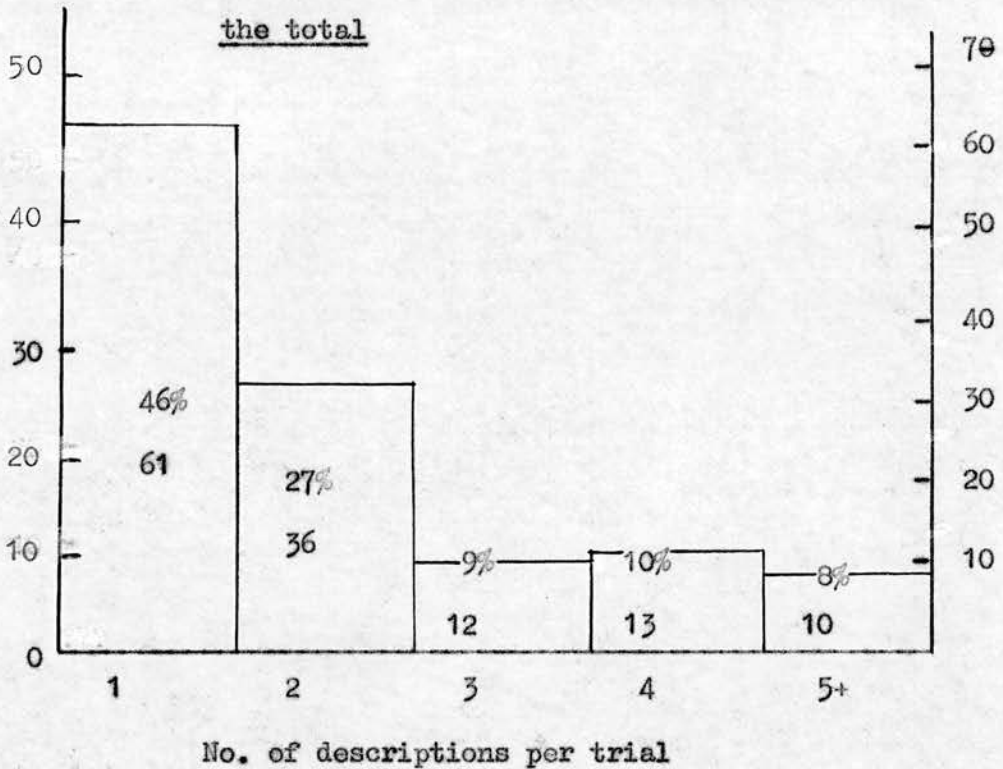


TABLE 5-11 Number of descriptions given as a function of number of alternatives.(shapes) available.

	Number of shapes in pool (Trial shown in brackets)					
	6(1)	5(2)	4(3)	3(4)	2(5)	
BLOCK I	45	33	26	22	18	144
BLOCK II	34	26	30	18	22	130
	79	59	56	40	40	274

Such a decrease would be predicted as the number of items became smaller since the discrimination task should become easier. It was not clear, however, if young children would show such an effect. A trend test for related groups, Page's L Test, was carried out and it was found that the reduction of descriptions was significant. ($L = 653$, $p < .01$).

2. Rejection of redundant information

For any message there is an ideal minimum which includes only the features essential for discriminating the object being described. This minimum adequate message requires the speaker to reject those features which carry no useful information or rather, redundant information, for the listener. Inspection of the data (Appendix A) shows that the children were not so good at rejecting redundant attributes. In the 138 trials, only 26 contain no irrelevant information. Of these 26, 14 are given in the first message, represented by the letter 'A' in Appendix A. The remainder require a combination of two or more messages to provide the attributes which constitute an adequate description. These are represented by 'C' in the Appendix.

The significance of this result is that the children were not following an 'ideal' strategy whereby they carefully searched the array in order to select the unique feature or features belonging to the selected item. This is scarcely surprising, since everyday communication, i.e. conversation, contains much redundant information. Indeed, research suggests we have a need for it. Although speaking in a slightly different context, Goodnow states the case regarding redundancy: "Under what circumstances does redundancy help, hinder, or make no difference? Even this question may involve a misleading singleness of mind. I am not completely sure, for instance, that redundant choices are always intended, by the subject, to gather information. They seem sometimes to serve as ways of marking time, ways of underlining a phenomenon, or even ways of warding off distraction. If these purposes are involved

then "redundant" choices may be extremely useful." (Goodnow,¹⁹⁷²_A p. 100).

It would be of interest to see the proportion of non-redundant messages adults would attain in tasks like these.¹

If communication efficiency is measured by speed and accuracy then a full description of the object may be the best strategy in this particular task. After all it is almost as quick to say 'big red square' as 'big square' and as the former does not require a search through the array to determine the minimum attributes, it may well be arrived at more quickly. Thus it might be argued that those children who include the three dimensions of form, size and colour in every description are the best communicators. They provide the necessary information but more than the sufficient information. The dispute is whether the extra details act as additional cues to reinforce the message or as noise in the channel which might lead to confusion. This could be tested. In the present task only 26 first messages included all three attributes, and only two subjects (Lee, Sally) were in any way consistent in this behaviour.

One further point should be made. Inclusion of sufficient information to enable a correct choice to be made, might not be enough in itself to lead to a correct choice. A certain degree of clarity is also desirable. Young children are prone to repetition and ambiguity. In even a relatively simple task such as this, behaviour of this kind was observed including a certain amount of contradiction, e.g. Sally describing a big red square 'The big round one, the big square one, and its red and its round'. The fact that the big red circle had already been

1. Since these notes were written the author has conducted some informal communication sessions with university students using the same or similar material to that used in these studies. The predominant finding was that they, too, did not reduce the length of their descriptions as the number of alternatives decreased, meaning that redundant features were constantly included. They reported only changing attributes, however.

discarded made the listener's task easier, which would often happen in practice. But it is not difficult to imagine the problems which a child of like age might have with the above message and, for instance, Christine's 'Round square, big square round, round one, a big round one'. The amount of verbal information that 3 - 4 year olds can successfully process may be crucial in such cases. It should again be stressed that such messages are an exception in that they contained sufficient information in a single utterance. The dialogue was generally much more disjointed.

3. The speaker's performance as a partner in a dyad - the ability to modify the response.

The main hypothesis under test in this sub-task was that an ideal listener would improve the performance of the speaker. More precisely, if the listener were to provide informative feedback following an inadequate description would the speaker be able to profit from this and so modify his response? It was important that the feedback did not simply put words into the speaker's mouth. The information should be such as to require an inference on the part of the speaker. If the child did not profit from this, further help was provided as described in the Method.

A striking measure of the success of the speakers in this situation was that the experimenter failed to select the correct shape on only three occasions. This compares with the 31 incorrect choices made by the children in the earlier (houses) experiment (Chapter 4) when half the number of dyads (7) were operating.¹ This strongly suggests that the

1. Not too much should be made of this comparison, since apart from his greater efficiency as a provider of feedback, an adult has a number of other advantages as a listener, not least of which is a clear idea of the nature of the task.

'ideal' listener is having an effect. The degree to which the speakers modified their responses, however, is the important result, since it was this failure which marked poor performance in the earlier experiment (houses) and in work by Krauss and Glucksberg (1969).

Since 61 trials required only one description, 73 trials remain to be assessed. The detailed trial by trial performances of each subject following listener feedback are given in Appendix B. From this a summary of the main types of reaction are provided in Table 5-12.

TABLE 5-12 Types of modifications given by speakers as a function of listener's feedback (Based on Appendix B).

RESPONSE TYPE	FEEDBACK TYPE TO WHICH IT APPROXIMATES (See Method, p.)	FREQUENCY
RQ*	4	13
QQ	4	9
RME	3	14
ME	2	29
M	1	9
		<div style="display: flex; align-items: center; justify-content: center;"> <div style="display: flex; flex-direction: column; align-items: center;"> <div style="font-size: 3em; margin-bottom: 5px;">}</div> <div>50%</div> </div> <div style="font-size: 3em; margin: 0 10px;">}</div> <div>70%</div> </div>

R = Repeat of original description ME = Modified response as f of

Q = Response to direct question E's feedback
e.g. 'Big or Wee?'

M = Modified response (unsolicited)

* Inspection of Appendix B shows that the speaker's behaviour does not always put him clearly into one or another group. In such cases the exemplar is placed into the group most nearly representing the behaviour but being more, rather than less rigorous, e.g. M. ME. R. Q = RQ

Modified responses were rare in the house experiment. The present findings would suggest that this was a function of the almost total lack

of feedback from the listener. In the current task where the speakers had a sympathetic and helpful listener, reactions involving a modified response (M) accounted for approximately 70% of those trials requiring feedback. Perhaps even more notable was that half of the trials did not contain any repetition (ME and M = 50%). It is also clear, however, that even with an ideal partner, some 30% of the trials were not concluded without much repetition and eventual reduction to a question and answer technique (RQ and QQ = 30%). Also note that the number of trials that are modified spontaneously accounts for only 7 of the 72 trials. Distribution is shown as a histogram in Figure 5-2.

Yet, finally, the impressive thing about the children's performances as speaker was that half the trials did not require any response from the listener save that of choosing the described shape. This means that the figures on modification ignore the trials where all the decisions about what should be included were made as the children gave their first descriptions. For the most part these decisions **are** made (presumably) covertly, but there are examples of this process being apparently manifested in the child's language.¹

An attempt has been made to characterise the performance of individual subjects according to a description which most typified their behaviour. (Table 5-13). This is largely based on the manner of their descriptions as shown in Appendix B.

1. One instance is provided from David's record: 'A little red. I've got two red ones. This is a square one and what colour is it? Red'.

TABLE 5-15

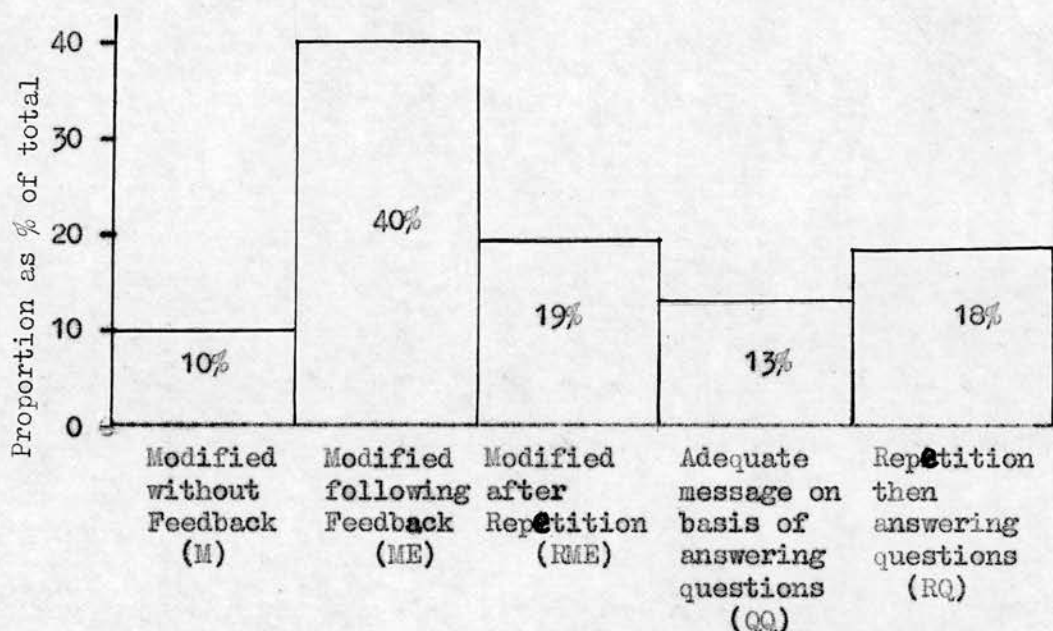
PERFORMANCE CATEGORIES OF INDIVIDUAL SUBJECTS

<u>Symbol*</u>	<u>Subjects</u>	<u>Total No. of Messages</u>	<u>Description</u>
-	Lee	(12)	First message usually adequate
-/ME	Sally	(14)	Roughly half first messages adequate, the rest require feedback from E to become adequate
	Clare	(17)	
	Christine	(20)	
-/RME	Elizabeth	(17)	Some adequate first messages. Tendency to repetition before responding to E's feedback in others
-/RQ	Alan	(16)	More than half trials adequate on first message, but prone to repetition in others and success dependent on direct questions
	Karen	(18)	
ME	Scott	(25)	Largely dependent on communication dialogue which leads to modified description
	Nicholas	(20)	
Q/ME	David	(26)	Roughly equal proportion of straight question - answering and genuine modification of responses
	Jamie	(31)	
R	Gregor	(30)	Much repetition but has ability to modify responses
RQ	Paul	(28)	Much repetition. Success depends on question answering
Q	Anna	(19)**	Distracted performance. Simple question and answer technique necessary

* See Table 5-12.

** Took part in only one block of trials.

Fig. 5-2. Categorisation of trials requiring 2 or more descriptions
(i.e. 2, 3, 4, 5+ in Fig. 5-1.)



Factors contributing to task failure.

We will conclude this section ^{by} considering the main factors in this experiment which have led to task failure. Some of these factors have been reported in earlier studies but it is necessary to indicate instances which may be peculiar to this particular task situation if the eventual aim of building up a comprehensive picture of communication behaviour is to be achieved.

This special situation with the ideal listener means that the emphasis has been on the speaker's reaction to feedback, but before discussing that issue there are two other factors which should be mentioned. One concerns the sort of apparent form confusions which existed for a number of children, such as calling a square, a round. This was mostly a case of applying the wrong label to a referent and though bound to hinder successful communication, it is something which minimal training can put right.¹ It should be pointed out, however, that although

1. Vygotsky long ago pointed out the influence of what he called the associative complex: '... one word may in different situations have different or even opposite meanings as long as there is some associative link between them. Thus, a child may say before for both before and after, or tomorrow for both tomorrow and yesterday.'

(Vygotsky, 1962, p. 70-71).

this is a relatively minor problem in a simple task like the present one, it does represent one of the pervasive difficulties in communication in general. The lack of a common definition gives rise to much of the misunderstanding between people. Difficulties in basic situations like this experiment, where three dimensions vary in a binary fashion, are a warning of what might happen where the possibilities for dissimilar definitions are many times greater.

The other general area of difficulty might be covered by the term egocentrism, according to some theoretical viewpoints. It has been argued elsewhere (page 132) that this term is unsatisfactory because of its unclear meaning and, accordingly, the behaviour concerned will be illustrated by examples from the text records. Two main types of behaviour can be distinguished.

1. Picking up and showing the selected item to the listener. This often happened early in the experiment and although the instructions emphasised the verbal nature of the task such behaviour suggested this aspect had not been appreciated. The response very often followed a question by the experimenter at the end of feedback: '... Which one do you mean?' This may often have been habitual rather than a function of not understanding the instructions. Showing something is more natural and efficient than a verbal description, particularly for a young child who is not yet a sophisticated verbal animal. It has not been sufficiently stressed, perhaps, that the artificial aspect of talking about something which could just as easily be displayed might well be playing a part in the children's responses to these tasks. When the children did seem to have grasped the verbal nature of the task, it was still noticeable that on occasions when a lengthy dialogue proved unsuccessful, some children would fall back on the showing response.

2. Using object to assist verbal description. The purpose of this behaviour seemed to be to facilitate message construction, in that the

child would point to the object as he described it. Usually it remained hidden while he did this, but one child held up the shape in full view of the listener as he described it, apparently unaware that such a procedure made verbal description superfluous. Behaviour which could be said to be close to some of Piaget's descriptions of egocentrism, occurred when some subjects' realisation of the speaker's role was to point to the hidden object and say simply, 'This one'.

Egocentric behaviour is sometimes defined as the child failing to put himself in the position of another person. In this sense egocentrism could be said to underlie much of the performance in this task. Having said this we know little more about the cause of failure. What we really need to know is what components underlie or contribute to inadequate performances. One ~~due~~ is the way in which the child indicates his misunderstanding of the problem and some of these are reviewed below.

1. Describing more than one object at a time. This was an obvious indication that the child was not carrying out the task as intended. It was an infrequent occurrence and it was not apparent whether it was a misconstruing of instructions or an ~~attentional~~ failure, that is, being unable to narrow the focus of attention on to one item.
2. Echoing the listener's feedback. A common event was for the listener's feedback to be repeated back to him by the subject. For example, if the experimenter said 'I have two red ones', the child would say 'I have two red ones (too)'. This echoic response revealed an inability to make the necessary inference that the experimenter was having difficulty in choosing a shape because the message was ambiguous. It appears that some children regard feedback not as indication of ^{the} listener's dilemma but as him telling them about his shapes. (Because he feels like it!)

An example from the record of one subject, Sally, illustrates the point that the straightforward statement of fact - listener's response

type 2 - often results in an inappropriate understanding of the listener's feedback.

Sally: This is square and red.

E: I've got two that are square and red.

S: I've got a big one and a little square one.

E: Which one do you mean this time?

S: The little one.

The child seems to recognise that the size dimension has been omitted from her description, but does not appreciate the significance of this fact. It requires the question before the critical information is forthcoming. It is tempting to speculate what the notion of the task is in the mind of the young child who performs poorly. To him it perhaps represents a game where he chooses a shape and talks about it for a while. The man opposite also chooses a shape and sometimes he may say something about his shapes. Then both he and the man hold up their shapes. If they are identical they go in a box. If they are not, then they put them back and he chooses another shape. (This pre-supposes he has an adequate concept of 'identical' in the present context). What the poor communicator seems to be critically unaware of is that the experimenter's choice is dependent on his description. It is not clear whether an appreciation of this causal connection can be given in instructions. It may be more fundamentally dependent on the stage which the child's thinking has reached.

3. Repeating the original message. As has been repeatedly stressed, good communication is marked by flexibility in behaviour. When the response becomes stereotyped, it loses any informative property to the listener. Persistent repetition of the original message in response to feedback, again suggests that the child fails to realise that the listener must have more details if he is to be able to make a correct choice. In this situation one again asks what does the child think?

Does he think that the experimenter guesses? When the objects match, does that represent good fortune?

4. Analytical descriptions. A further example of non-adaptive behaviour is what might be called an analytical description. Here the child gets bogged down trying to give a detailed account of the chosen object.

E.g. Gregor, 'Same as ... two sharp points and more and two sharp points at the top and a thing down there and a thing down there, etc..' (repeated five times). This child would appear to be highly field-dependent, so much so that he is unable to 'detach' himself sufficiently from the object to recognise and name the outline.

5. Premises but no deduction. There are cases where the child seems to have all the necessary information to hand for providing an adequate description, but he nevertheless fails to make use of his own observations. In behaviour which is reminiscent of some shown in the experiment investigating judgements of same and not-same, Scott says:

'Now I've only got a wee round and a big round. It's red and it's round'.

In the first part of this message, he clearly indicates that he has two shapes left, that they are both round and that one is little and one is big. The critical difference is therefore size but when he actually delivers the message he leaves out this feature. Neither shape nor colour are helpful since they are the same for both objects. This suggests that the concept of critical or changing attributes is not one that penetrates the awareness of this child, nor, probably, any other in the sample.

Although this section has stressed weaknesses in performance it would not be appropriate to end on this note given the generally high standard of performance. It has already been reported that nearly half the objects are adequately described in the first message. Furthermore, the records show that the subjects can produce self-initiated modifications

of the descriptions, that is they can recognise the shortcomings and inadequacies of their messages and compensate for them. Some examples are given below.

EXAMPLE 1 - Christine

In Trial 2 a Big Red Square was chosen and adequately described. In Trial 3 the dialogue went as follows:

C: A little squarangle

E: A little square

C: Like the big one

E: Like the big one

C: But not a big one. A little one

The phrase 'like the big one' referred to the previous Big Red Square. This is an unconscious technique frequently followed in adult communication when we know that the pronoun referred to the thing just described. The experimenter as an adult would handle such a message easily, but a listener of the same age as the speaker would almost certainly be confused and tend to think a big one was being described. Note that the experimenter in this and the other examples is doing nothing other than repeating the speaker's message. But this may be enough to draw the attention of the child to what he said and cause him to recognise and correct inadequacies when necessary. In this case Christine makes it explicit that she has in fact chosen a little square, but the colour of the square remains uncertain. One would assume, however, that if it is like the (previous) big one, it is red.

EXAMPLE 2 - Gregor

Three shapes are left, all red.

G: A little white one

E: A little white one

G: A red one! Sorry (smiles)

EXAMPLE 3 - Lee

L: A wee round square one

E: Wee round ... A wee round square one.

L: No (smiles as sees contradiction) A wee round red one

EXAMPLE 4 - Nicholas

N: A white square

E: A white square

N: Just a wee one

These few examples show that young children can be aware of the dual nature of a communication task and they can adapt their behaviour in a way very similar to the adult in such situations.

IV - The effect of an 'ideal' speaker on the performance of the child as listener.

These investigations of the component parts of the communication task behaviour have arisen out of the findings from the earlier studies. As pointed out in reviewing the results from the communication condition of the 'Houses' study, (Chapter 4), adequate descriptions did not necessarily yield correct choices on the part of the listener (Table 4-9 and p. 82 and 91). Even when they were given all the information to identify it, the item in question was still not chosen. This happened in one-third of the cases and seemed a logical area in which to extend the investigation. If it were generally true that the young children were unable to operate in this situation on the basis of adequate messages then the exercise would be futile as a method of cognitive enquiry. It was necessary to establish if this was in fact the case.

For this purpose the experimenter acted as an 'ideal' speaker. He was ideal in the sense that he provided sufficient information for the child listener to choose the item described. He was also ideal in that he provided no more than the necessary message, omitting redundant information. A feature of many of the children as speakers was that, even when adequate, the performance was inefficient. Messages tended to be repetitive or rambling and included a number of irrelevant attributes. To avoid the signal being obscured by noise, the ideal speaker's messages were based on a rule designed to give the most parsimonious yet sufficiently complete description to enable discrimination. This was as follows:

1. Look for and transmit the unique attribute if there is one.
2. If no unique attribute, look for the attribute which is possessed by the selected item and the least number of other items - the minimum attribute.
3. Transmit the minimum attribute plus any other attributes needed to differentiate the selection from its sub-set of items, i.e.

those others which possess the minimum attribute.

An additional outcome of this design was to involve the child in the task more fully. Earlier studies had shown that the listener's role was a particularly passive one. This was partly because the stimulation provided by the speakers was uninspired and partly because of a failure to realise the function of the listener. The adult speaker was designed to eliminate the first problem and the more familiar setting of the child responding to an instruction by the experimenter was expected to alleviate the other weakness. With his peer the child may or may not know what is happening. Doing things in response to messages from another child is an atypical situation. Even if the experimenter's initial instructions are understood, the child speaker has only to fail to produce an appropriate signal once for the listener's expectation to be disappointed. The probability of unproductive communication is reinforced with each additional failure and the likelihood of complete breakdown is high since the threshold of focal attention for young children is low.

Thus in the experiment to be described the usual mental set of young children in the testing situation was to be utilised, that is one of broadly doing what they were asked to do. Different material was used from that in the previous ideal listener condition, but, as in that experiment, the items were familiar to the children: the set of teddy bear pictures used in Study I of this series.

Method

Subjects 17 children, 8 male, with ages ranging from 3 years 4 months to 4 years 8 months, mean age 4 years.

Materials Two sets of six pictures of teddy bears, as used in Study I, varying on three attributes: colour of coat, size of hat, presence of stick. Two 6" high boards to screen arrays. Two 20" by 4" trays divided into six compartments to hold the picture cards.

Ideal speaker's strategy The experimenter as speaker operated according to the strategy set out in the introduction. Translating this in terms of the communicable material used, suppose that the speaker first selected picture C from the set below.

- A Red coat, small hat, stick
- B Red coat, small hat, no stick
- C Red coat, big hat, no stick
- D Blue coat, small hat, stick
- E Blue coat, small hat, no stick
- F Blue coat, big hat, no stick

By the rule he would first look for the unique attribute. Picture C does not have a feature not possessed by the other pictures. The second stage is to look for the minimum attribute. Picture C has a big hat and only one other picture (F) has a big hat. Thus the first part of the message is 'Big hat'. The remaining task of the speaker is to distinguish picture C from its subset C and F. Picture C has no stick but neither has picture F. Picture C has a red coat while picture F has a blue coat. So coat colour is the attribute which differentiates C from F. The adequate description or message is therefore: 'Big hat, red coat'.

The ideal speaker operated according to this rule throughout the task, in terms of the size and composition of the picture set at the time he delivers his message. He did not, for instance, compile a description as if he were differentiating from the whole set, when there were only three pictures remaining.

Instructions and procedure. The experimenter faced the child across a low table and addressed him as follows: 'You've seen these pictures before haven't you? (laying out sets) There's some for you and some for me. My pictures are the same as your pictures. Can you put together the pictures which are the same? (If the child was unsure, the experimenter helped by taking one picture from his set and asking the child to find the one in

his set which was the same - the matching sets were built up in this way). Now you take those pictures and put them in there (pointing to tray) and then put them behind your screen so that I can't see them. We both have the same lot of teddies, don't we? Now, I'm going to choose one of the teddies. I'll tell you which one I've chosen and you pick the one I tell you about from your pictures. Listen carefully. (The experimenter gives a description e.g. "It's a teddy with a big hat and a red coat"). Show me the one you think it is. (The experimenter laid the subjects choice in the middle of the table and put his own selection beside it). Are they the same? (If 'Yes' - correct, they were placed face upwards in a discard box to one side in view of the subject and the experimenter gave the next description. If 'No' or 'Yes' - incorrect): Look carefully. Are this picture and this picture the same? (If the child failed to report the differences, the experimenter pointed them out and the pictures were returned to their respective arrays). Now I'll choose another teddy and tell you about it. Listen carefully.'

The complete set of pictures was worked through twice, called hereafter blocks one and two. The task was completed in one test session lasting about twenty minutes and was videotaped.

Results and Discussion

Group data

Table 5-14 shows the number of errors made by each subject in the two blocks of trials. The total number of wrong choices was small, 29, out of the 170 descriptions given. The overall error rate was thus 17%. Less errors were made on Block 2 suggesting a practice effect, but this difference was not significant. The error distribution is given in detail in Appendix C and illustrated graphically in Figure 5-2. Inspection of this shows that most errors occurred when the number of alternatives available was greatest. 21 out of 29 mistaken choices were made in the first two trials of each block, when the size of the array was five or

TABLE 5-14
Number of Errors by listener (child)

<u>Subject</u>	<u>Block 1</u>	<u>Block 2</u>	<u>Total</u>
Alan	1	0	1
Lee	0	0	0
Dale	0	3	3
Linda	1	0	1
Scott	2	1	3
Jamie	1	3	4
Gregor	1	0	1
Margaret	0	1	1
Elizabeth	3	2	5
Nicholas	1	0	1
Karen	0	0	0
David	1	0	1
Sally	0	0	0
Clare	1	0	1
Paul	1	1	2
Anna	4	0	4
Christine	1	0	1
	18	11	29

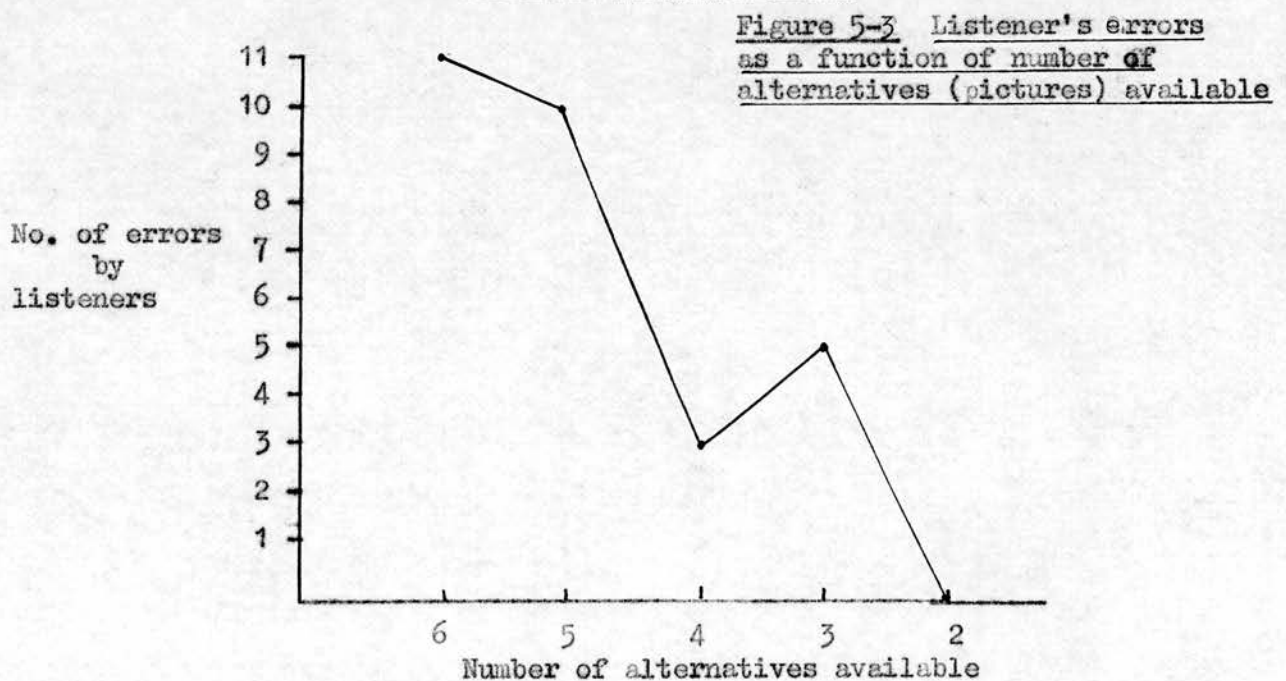
n = 17

TABLE 5-15

Incidence of mistaken pairs

<u>Picture described</u>	<u>Picture selected</u>	<u>F</u>
B	A	5)
B	E	5) 13
B	C	3)
E	B	2)
E	D	1) 4
E	F	1)
F	C	1)
F	D	1) 3
F	E	1)
A	D	1)
A	F	1) 2
D	E	1)
		23*

* The difference between this figure and that of 29, (Table 4-1), is explained by the exclusion of perseverative errors by individual subjects in the data on type of picture giving rise to mistakes. When S makes persistent error it is counted as 1.



six. The number of errors was too small to allow a test of significance to be made.

There is also a pattern evident as regards the type of item that gives rise to difficulty. Table 5-15 shows the incidence of mistaken pairs. Pictures B and E accounted for 17/23 or 74% of the mistaken selections. They are the pictures with the least distinctive features - they do not have big hats and they do not carry sticks. This 'silent' minority among the bears has been mentioned before, since the same error pattern was found with this material in Study I (see page 104). It appears, therefore, that even when adequate descriptions are provided the perceptual problems presented by these pictures, as revealed in Experiment I, are not overcome. The order of items selected was based on random number tables, but it is possibly significant that in eight out of thirteen B/E errors, those pictures occurred first or early in the block. As something of a counter to this, however, the adequate descriptions in each case was also a full description, that is, all three critical attributes were included in the speaker's message.

Individual performances

Table 5-14 shows that five children achieved faultless performances in Block 1 and eleven had complete success in the second block of trials. Three subjects (Lee, Karen, and Sally) correctly interpreted all the messages in both sessions, and eleven children - two-thirds of the sample - had one or less errors in the task as a whole.

The main finding, therefore, is that given the minimum but adequate amount of information to make a choice, most of these three and four year olds are able to determine which of a number of similar pictures is being described. The videotape records showed the confident way in which the children as listeners performed. They would appear to check off the features transmitted by the speaker against their arrays and selection was often accompanied by such phrases as 'It must be this one' or

'I know which one it is'.

Although errors were relatively few in number, the videotaped record is a useful aid in trying to account for mistaken selections. It revealed that a major cause of errors was a tendency to make choices based on only part of the information provided. Sometimes the visual record showed that the child actually selected a picture before the speaker had finished his message. At other times selection awaited completion of the message, but it was evident that not all the information had been processed. It is likely that lack of attention and predispositions set up by the prevailing situation contribute jointly to many wrong choices. One or two examples illustrate the problem.

Elizabeth (3 years 11 months)

Experimenter: (Picture B) It's got a wee hat, a red coat and no stick.

Elizabeth: (Hesitates, appears to deliberate - selects picture A)

E: (Pictures placed side by side) Are they the same?

E1: (Shakes her head)

E: You're not listening to what I say are you? You've got to try and get the same one.

E1: I've got two red coats. I've got lots of red coats.

It looks as if Elizabeth 'switched-off' after the second component of the speaker's message. Her selection, 'A', matches that of the speaker as far as size of hat and colour of coat are concerned. If she had also taken into account that the described picture did not have a stick she would have chosen accurately. Her last remark suggests, but no more, that she may have based her choice solely on colour of coat. This is supported by the results of Study I which showed that coat colour was the dominant feature.

Another child seemed so anxious to be actively involved in the game that he selected a picture before the experimenter was even able to

start his first message. Kagan's measure of cognitive style would undoubtedly categorise this child as 'impulsive' (Kagan, 1966). A look at part of his performance record shows how this impulsiveness (if that is what it is) affects his behaviour.

David (3 years 8 months)

Experimenter: (Picture B) It's got a red coat and it's got ...

David: (Breaking in) A stick!

E: .. a wee hat, a red coat and no stick. Which one do you think it is?

D: (smiling) A red. (selects picture A and hands it across)

E: Are they the same?

D: Yes

E: Look carefully, are they the same?

D: Yes, because that one's got a stick

David does not appear to understand that he must base his choice on the speaker's message. Right through the first block of trials he was liable to select a card before the speaker had started his message. Although the camera was not able to pick it up, it is probable that he had made his choice before the speaker had delivered his message and it was fortuitous that the two pictures matched on two features. His smile and mention of 'red' possibly indicates that he has recognised common ground between his and the speaker's selections. Later, when he had settled down, he performed well.

Here is another example.

Scott (4 years 4 months)

E: (Picture B) It's got a red coat and a school cap.

Scott: A red coat ... Must be this one (selects picture C)

E: Are they the same?

S: (Nods) Yes

E: What about the hats?

S: One's got a top hat.

It is likely that Scott repeats the part of the message that determines his choice - 'red coat' - but does not mention the additional feature which would enable him to make a correct choice. He seems as certain as those who choose correctly, i.e. 'Must be this one'. It is perhaps this degree of certainty which causes him to maintain that the two selections are the same.

Errors in this task were distinguished by being perseverative. Fifteen of the wrong choices (see Appendix C) might be said to fall into this category. This perseveration was partly accounted for by the fact, already mentioned, that certain items in the arrays habitually gave rise to confusion. It was surprising, however, that as many as six subjects should fail, two or three times, to match picture with description. A possible explanation is that, having shown the experimenter his choice which results in a mismatch, the child reasons that the speaker will choose the right one next time, the right one being the child's selection. This betrays a fundamental misconception of the task and might well be explained by Piaget as egocentrism. Only one subject, Anna, provides any support for this possibility. On a number of occasions she says, when comparing selections, that they are not the same 'because you choosed that one', and in one instance rather exasperatedly, 'You choosed that one again!' But when she realised that her choice was determined by the speaker's message, rather than his or her choice, she handled the task well and made no errors in the second session. In fact, in one instance she was able to change her choice of picture in mid-decision, as it were, when she realised that she had not taken account of hat size.

One or two of the younger and slower subjects required that the task be explained in simpler more concrete terms. The instructions were prepared with this in mind, but it transpired that for some children the

instructions were still too verbal or abstract. With Paul the experimenter found it helped if he showed the subject the picture he had selected - the blank side facing the child - and then described it. The message was then followed with 'See if you can find this one among yours'. These subjects also indicated quite clearly that they could only search for one dimension at a time. This was very often an unhelpful strategy. From a message like 'Blue coat and stick', blue coat would be 'picked up' and the child would find a teddy with a blue coat. If the speaker then repeated the message the child might be able to check to see if it also had a stick. In most cases the subjects in error did not reach this second stage, but where they did and still chose incorrectly it could be because the first criterion gets forgotten and the search becomes solely one of looking for a picture having a stick. In such a situation stick and red coat might be selected. Although there are some errors like this and the above explanation seems the most plausible to account for it, it nevertheless remains a hypothesis.

Summary

1. When presented with messages that were only minimally sufficient to enable discrimination of one picture from an array of similar pictures, young children performed significantly above chance level.
2. Though the messages were constructed according to a rule of parsimony, it appeared that the absence of additional information did not affect performance adversely.
3. It may have been that the complete absence of 'noise' - repetition, irrelevant details etc. - compensated for the minimal nature of the descriptions.
4. Whether what has been called the minimum adequate description is more or less effective than a full description of critical attributes each time, remains a matter for verification.
5. The relatively few errors seemed to be due to incomplete processing

of the verbal message and some perceptual confusion between the stimulus material itself. In line with this, mistakes tended to involve pictures which gave rise to most judgement difficulty in the earlier experiment with this material (Perception of Differences).

6. For some subjects task instructions were not sufficiently explicit. Breaking down and making the procedure more concrete removed the misconceptions.
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Chapter 6 A talking doll as a partner in a communication situation

Introduction

Some studies have been described of children in communication situations with one another and together with an adult in the role of 'ideal' partner. The latter condition led to an improvement in performance which was largely a result of the adult being able to compensate for weaknesses in the child's performance. It was now of interest to know whether there was a situation where the child could adapt to the needs of others. It was already established that when working in pairs the amount of consideration given to the needs of the partner, although not negligible, was of a limited nature. Previous research (Glucksberg et al., 1966; Flavell et al., 1968) and Piagetian theory suggest that children are too self centred to be able to modify their behaviour to the requirements of a purposive communication task. It could be argued, however, that unless a situation is devised where the needs of the other are apparent and built in to the task, a true test of ^{the} egocentric hypothesis has not been carried out.

What is being suggested is that the child may have it in his power to play the role of speaker or listener in the communication task, adequately, as long as he recognises the particular demands that are being made of him. A mature person accepts these demands naturally since it is understood, even if only implicitly, that communication could not work without certain 'rules' of behaviour. If the situation in itself does not induce competent communication behaviour on the part of the young child, are there any conditions that might? In his analysis of the problem Flavell proposed that the speaker's 'model' of the listener crucially affected his communication efficiency. By 'model' he seems to mean the perceived needs of the listener in that particular situation. The listener also has a model of the speaker, less critical to the success of the task, but also important.

Both Flavell and Glucksberg argue that because these models of the other are insufficiently developed, the pre-school child is a poor communicator. It is presumably the case that with little else to go on, the perceived model of the other is the same as the perceived model of the self. In outward appearance and behaviour the other child is broadly the same, so the assumption is that his needs are the same. The role playing studies of Flavell et al. (1968) indicate, for example, that in choosing presents for mother and father the child selects items which appeal to him, e.g. toy train, rather than gifts that one would consider appropriate for adults. A projection of the self image on to others seems to be in operation.

This account seems to be somewhat at variance with recent findings by Donaldson and Lloyd (1974). In their work with a talking doll they found that young children were willing and able to provide assistance of a cognitive nature for an organism which is presented as inferior to themselves. Notably they have judged statements by the doll about the visual world indicating when he was wrong or right. A deliberate emphasis on the backwardness of the doll and on his need for help from the children seemed to be highly motivating for the young subjects. Perhaps the critical difference between this and previous studies in this general area is that the child was provided with the impetus to make a deliberate or intentional allowance for his partner. It may be objected that this is an artificial piece of behaviour brought about by intensive training. In fact Donaldson and Lloyd found that the children needed little encouragement to assist the doll, but even if they had, the finding still demonstrates that the view which sees the young child in a rigidly egocentric framework may be misleading. Further, if the behaviour generalises to a quite different situation, the position will have to be re-assessed.

It was proposed that the talking doll should be used in a suitably

prepared communication experiment to test the effect that this known poor performer had on the children's behaviour. Since they knew that the doll was liable to make errors, would they, as listeners, notice and correct any such errors, and perhaps more interestingly, as speakers, would they adapt their performance to suit the doll?

A clear hypothesis is not easily presented. There are two conflicting trends: the well-known findings in egocentrism highlighting the young child's inability to take account of others, and the results achieved with the talking doll, where the laboured efforts of another have been instrumental in gaining co-operation and assistance of a sophisticated order from young children. Nevertheless it could be argued that previous work with the talking doll has not been a true test of communication behaviour. The aim of this study was to provide such a test to discover whether the limitations imposed by Piaget's 'cognitive egocentrism' would show themselves. It also provided the opportunity to extend a technique which had already proved useful in the study of cognitive development.

Experiment I

The standard experimental set-up using the talking doll has already been described (See Chapter 2). Some special problems arose in the present experiment, however. One was to present the talking doll's role so that it was plausibly an inferior performance without detracting from the aims of the task. Ideally the doll should make the sort of errors produced by young children in such a task, since it was important to know if the children recognised in others what they failed to eliminate in their own performance.

Basically the doll provided inadequate messages of the type the children produced in the earlier experiments conducted. Inadequate messages were largely those where one or two critical attributes were missing from the description. To give a simplified example, in the

objects possessing attributes 'AXY' and 'BXY', 'A' and 'B' are the critical attributes. Any message not including 'A' or 'B', (i.e. 'X', 'Y', 'XY') is an inadequate message since it does not allow the listener to discriminate the chosen object. To lessen difficulty the doll avoided the excessive repetition, rambling or contradiction which characterised many of the children's descriptions. If repetition did occur it was a straight repeat of the original description when the listener did not ask for further information.

The precise nature of errors or omissions made by the doll was dictated by the material used as well as by the feedback from the listener. To ensure a sufficient degree of ambiguity without having an overlarge pool of objects, it was decided to use relatively abstract items. Having in mind the limitations on the types of attributes which can confidently be used with young children, blocks varying on three dimensions - size, with/without cross, with/without hole - were used. The advantage of this material was that it did not encourage overmuch irrelevant comment which everyday objects like animals or cars might have done. To this extent the subjects were helped in that their attention was directed towards the critical features, but at the same time the opportunity for introducing irrelevant detail was not wholly excluded. Colour, (when used as well as 'cross') shape and type of material (i.e. wood) were superfluous attributes which could be mentioned.

The essential guideline for the doll's performance as listener was that it would not select the correct item unless given an adequate description. If a child was unable to give an adequate description, the doll deliberately made an incorrect choice. During the task, the doll as listener encouraged the child to give him more information when necessary but in no way attempted to lead the subject. The doll's remarks

were confined to statements like 'I'm not very good at this game. I still don't know which one you've chosen. Can you tell me more about the brick?'

As speaker the doll's role was more complicated. To be adequate, a description typically required information about three attributes. One of these was given in the first message, but the remainder had to be 'derived' from the doll by means of suitable feedback from the listener. The child had to satisfactorily indicate to the speaker that he was in a quandary because the doll's message was in some way insufficient, ambiguous, or obscure. If the child confidently asserted he had made a choice, despite the message being inadequate, the doll allowed the child to take that decision. When uncertainty prevailed, however, the doll would seek to extend the communication procedure by following a prepared routine. This is set out in detail in the Method section under 'Instructions'. The critical factor, always, was to ensure that the child received no additional information unless he had 'earned' it.

The experimenter's role in this task had necessarily to be a reduced one. Apart from giving the initial instructions, the experimenter confined himself to manipulating the material on the doll's behalf, which included putting the selected blocks in the box provided.

One further problem concerned the order of presentation. In a traditional design, half the sample would have the condition as speaker first, half the condition as listener first and reverse their roles in the second part of the experiment. Those subjects, however, who took the role of listener first, would inevitably receive the benefit of the doll as a model for the speaker role. This would seriously affect the value of the findings for their subsequent performance as speakers.

Since the main purpose of the experiment was to see how young children would adapt their performance as speakers for something like the talking doll which had a proven record of incompetence, it was thought

undesirable to prejudice this aim especially with the relatively small sample involved. This meant that the extent of the influence of the doll's role as listener on the child's performance as listener could not be assessed. But, since the doll's contribution in this context was largely a passive one, restricted to remarks like 'I'm not very good at this game. Can you help me some more?' it was thought the influence would be minimal. Nevertheless such a factor needs to be borne in mind when interpreting the results. There was also the possibility of a practice effect, caused by the child's own experience as speaker, on his performance as listener. This possibility was not controllable and is anyway a function of the child's own behaviour, and not a model from someone else.

Finally, it was thought that the data already available on the influence of a model listener on subsequent performance as listener (Chapter 5, Study IV) were sufficient to allow concentration on the present task, namely that of testing the motivating effect of the younger, more helpless 'organism' as seen in other experiments with the talking doll.

The blocks chosen and the order in which they were selected was constant across subjects. If a very much larger sample had been available a random order could have been adopted, but if it had been used with this sample a variation of difficulty would have resulted which would have been distorting. It was desirable, for instance, to insure that each block chosen required the maximum number of features so as to encourage a high level of communication and a constant level of difficulty. This in itself imposed restrictions on the order. In the 'Child as Speaker' condition subjects were at liberty to select blocks in any order and thus data was obtained about order preference and its possible effect on communication.

Method
Subjects

Sixteen children, 8 male, 8 female, ages ranging from 3 years 9 months to 5 years 1 month. Mean age for the group was 4 years 4 months.

Materials

Two sets of identical wooden blocks for speaker and listener varying on three dimensions: size, possession of cross, possession of hole. Each set was made up of eight blocks. These were as follows: big block with cross and hole (BXH); big, no cross, hole ($B\bar{X}H$); big, no cross, no hole ($B\bar{X}\bar{H}$); little block with cross and hole (LXH); little, cross, no hole ($LX\bar{H}$); little, no cross, no hole ($L\bar{X}\bar{H}$).

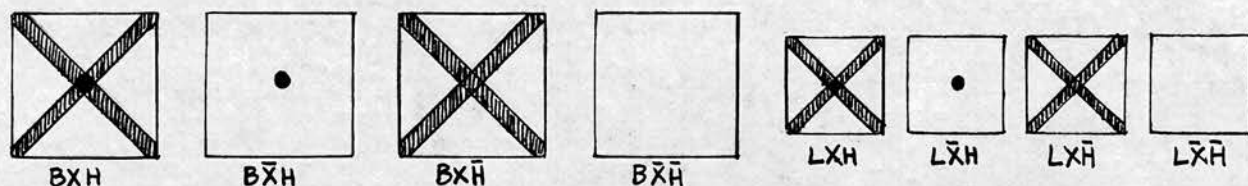


Fig. 6-1 Stimulus material used in Talking Doll Experiment (1)

The big blocks were 6.3 x 6.3 x 3 cm and the little blocks 3 x 3 x 3 cm. The holes were bored centrally, 1.3 cm diameter for the large blocks, 0.7 cm for the small ones. The crosses were drawn diagonally in broad stripes with a red marker pen on the horizontal surfaces. They are illustrated in Figure 6-1.

Two cardboard boxes 14.5 x 11 cm, one red, one white. Two wooden screens 60 cm wide and 17 cm high.

Procedure

The standard experimental situation with the talking doll has already been described. The subject was told that the doll, Chu-Chu, wanted to play a game with some bricks he had. Before the bricks were produced, the experimenter told both parties (doll and child) that this **was** a game where they must help each other. The child must listen carefully to Chu-Chu and do what he asked and help him when he needed help, and the doll must listen carefully to the child and do what he was told.

The bricks were then laid out to show that the child's set of bricks

matched the doll's set of bricks. The experimenter took care to use no labels referring to attributes of the bricks when setting them out. When the child was satisfied that he and the doll had identical sets of bricks, low screens were produced which obscured the materials but otherwise left the participants in full view of one another.

As explained in the introduction, the children always played the part of speaker first, followed by a session as listener. As speaker the child had to choose bricks one at a time and communicate his choice to the doll so that he could select the same brick from his set. When a set of descriptions for one brick (called a trial) was complete, the child and the doll (i.e. experimenter on its behalf) put their chosen bricks into boxes provided. The session consisted of four such trials. At the completion of the trials, the screens were removed and the selections compared. The choices were placed side by side by the experimenter who asked, one by one, if the pairs of blocks were the same. If the child said 'No' he was asked for a justification for his response.

It was then the turn of the doll to act as speaker and instructions were given accordingly (see below). At the end of the session of four trials the selected bricks were again compared and the child asked to evaluate the pairs. The experiment was videotaped and lasted 15 - 20 minutes.

Instructions and Preamble

	<u>Child as Speaker</u>	
Experimenter.	Your turn to go first,	Listen carefully,
	(child's name)	
	Chu-Chu, because is going to tell you about a brick	
	he has chosen to go into the box. See if you can choose	
	the same one. You choose a brick,, and tell Chu-Chu	
	about it so that he can choose the same one. Do you	
	understand what you have to do, Chu-Chu?	
Doll	Yes. I have to listen to and then choose the brick	
	which he tells me about, the <u>same</u> one, and put it in my box.	

- E That's right, Chu-Chu. Do you understand what you have to do?
- (If the child is uncertain, the experimenter repeats the instructions)
- Right you choose a brick and tell Chu-Chu about it.
- (When the child's description is inadequate):
- D Can you tell me some more about the brick,? I don't know which one you mean.
- (If still inadequate, doll repeats description given by the child)
- I'm not very good at this game, Will you help me as much as you can so I can choose the right brick? Can you tell me any more about the brick?
- (If still no addition to message):
- Well, I'll have to guess - perhaps it is this one, (Chooses wrong one).

Doll as Speaker

- (It may be useful at this point to re-read the paragraph in the Introduction about the doll as speaker (p.190-1)).
- D Can I have a turn now, ? And I'll tell you about my bricks. But if I'm not very good at telling you, you must help me, so that you can choose the same brick as me.
- E Yes, , you must try to choose the brick that Chu-Chu tells you about. But Chu-Chu won't be as good as you, so you might have to help him. If you don't know which brick Chu-Chu has chosen, see if you can find out by asking Chu-Chu.

The detailed procedure followed is given in Tables 6-1 and 6-2. This does not claim to cover every eventuality and this format might not always be followed rigidly. The guiding condition was that after the first message, the child must earn the additional attributes that would determine the correct block. If a child persisted in no response or indicated that he wanted to make a choice, he was allowed to do so.

TABLE 6-1

Details of procedure followed when child's response to doll
speaker's message justifies the supply of further information

DOLL'S FIRST MESSAGE:	The first one I've chosen is a <u>big</u> block
EXAMPLES OF ADEQUATE RESPONSES BY CHILD:	- I've got <u>four</u> big blocks, which one do you mean? - You need to say more than that - Has it got a <u>cross</u> /hole? etc.
SECOND MESSAGE:	It's got a <u>cross</u> on it
(IF RESPONSE ADEQUATE) THIRD MESSAGE:	It's got a <u>hole</u> in it.

TABLE 6-2

Details of procedure followed when child's response does not
justify the supply of additional information

DOLL'S FIRST MESSAGE:	The first one I've chosen is a <u>big</u> block		
CHILD'S REPLY:	No response		Child announces verbally a choice based on inadequate information e.g. 'I know which one it is, it's got a hole and cross'.
DOLL:	Do you know which one I've chosen		I didn't say that - I said ... (doll repeats first message)
CHILD:	Yes	No	No response
DOLL:	Put it in the box then	Why not? (If appropriate reply gives second message)	Repeats 1st message

Order of giving attributes

1. Doll: The first one I've chosen is a big brick
 (2nd attribute) It's got a cross on it
 (3rd attribute) It's got a hole in it
2. The second one I've chosen has got a red cross on it
 (2nd attribute) It's a wee one
 (3rd attribute) There's no hole in it
3. The third one I've chosen is a big one
 (2nd attribute) There's no cross on it
 (3rd attribute) There's no hole in it
4. The last one I've chosen has got a hole in it
 (2nd attribute) It's a big one

(N.B. Although the 2nd. and 3rd. attributes are specified in the above protocol, if the listener enquired about a specific attribute (e.g. 'Is there a cross?') rather than generally indicating he needed more information, then that attribute was provided.)

ResultsChild as Speaker

In assessing the performances of the children as speakers, among the aspects considered were:

- (i) The communicative adequacy of the descriptions
- (ii) The effect of the material on selection and description
- (iii) The significance of different types of communication
- (iv) The degree of adaptation to the needs of the listener.
 (i.e. the doll)

Communicative adequacy of messages

Table 6-3 is a summary of the detailed record to be found in Appendix D. The Table shows that the first item chosen needed, on average, approximately four messages before the listener (the doll) made his choice, whereas the fourth block chosen needed, on average, one or two

messages. To see if this reduction was significantly related to the number of alternatives available for each trial, Page's Trend Test was administered. The number of messages reduced significantly in the expected order ($L = 379.5$, $p < .01$). The data on attributes, however, also in Table 6-3, shows that the number of attributes reported remained constant over trials. This was consistent with earlier findings (see p. 61).

In assessing the speaker's performance a measure is needed that indicates whether or not the description of selected blocks enables the listener to pick out the self-same items. This index has been referred to in previous studies - message adequacy - and the relevant data are presented in Table 6-3. It shows that 21 out of 56 messages (37.5%) were adequate. Of the remaining 35 messages, 30 omitted detail about one attribute but only five messages ignored two attributes. The table also shows that 36 out of 56 messages (64%) included some irrelevant information, either non-critical main factors or features totally irrelevant to the discrimination problem. More data and a discussion of message types will be found below when individual differences are presented.

Effect of material on selection and description

It is of interest to know if the properties of the material used had any specific effects on the communication performance of the children. There was a consistent tendency for subjects to choose blocks with 'positive' attributes, that is 'with cross' rather than 'without cross', 'with hole' rather than 'without hole', 'big' rather than 'wee'. This is summarised in Table 6-4.

Each subject was given a score based on the number of 'positive' attributes and 'negative' attributes included in blocks chosen. A Wilcoxon Test showed the difference in type of attribute preferred was significant ($T = 12.5$, $p < .05$). When the scores were weighted to take account of order of selection, (see Table 6-5) the significance strengthened ($T = 6$, $p = .01$).

TABLE 6-3

Distribution of message categories for children acting as
speakers in a communication situation with a talking doll

(summed data, n = 14)

MESSAGES			ATTRIBUTES		CATEGORY OF COMPLETED MESSAGE									
TRIAL	TOTAL	MEAN	TOTAL	MEAN	A	AI	C	CI	EA	NI	NI1	NI2	EN	
1	54	3.9	29	2.1	0	0	2	1	3	6	3	2	11	
2	44	3.1	31	2.2	1	0	3	3	7	3	3	1	7	
3	38	2.7	33	2.4	0	2	1	3	6	1	6	1	8	
4	23	3.6	31	2.2	0	3	1	1	5	2	6	1	9	
TOTAL					1	5	7	8	21	12	18	5	35	

A = Adequate (no redundancy)

C = Combined descriptions adequate

I = Descriptions including irrelevant attributes

N = Inadequate

NI(2) = Inadequate, one (two) attribute short

TABLE 6-4

Relative choice of 'positive' and 'negative' attributes

	BIG/X/Hole	WEE/ \bar{X} /No Hole
SIZE	31	25
CROSS	33	23
HOLE	32	24

TABLE 6-5

Block preference as a function of order of selection

BLOCK	ORDER OF SELECTION				TOTAL	WEIGHTED TOTAL*
	1st	2nd	3rd	4th		
BXH	4	3	1	1	9	28
$\overline{\text{BXH}}$	1	2	3	2	8	18
BXH	3	1	3	2	9	23
$\overline{\text{BXH}}$	0	2	2	1	5	11
LXH	4	2	2	1	9	27
$\overline{\text{LXH}}$	1	2	2	2	7	16
LXH	1	1	1	2	5	11
$\overline{\text{LXH}}$	0	1	0	3	4	6

* Taking into account order of selection, i.e. a score of 4 for 1st choice down to 1 for each 4th choice.

A breakdown of block choices, given in Table 6-5, shows up the difference more sharply. The contrast is most marked when the number of choices including cross and hole (BXH and LXH) are compared with those including neither cross nor hole ($\overline{\text{BXH}}$ and $\overline{\text{LXH}}$), that is 18 against 9. The block with all the 'negative' features (i.e. the little block with no cross and no hole) was the least popular with only 4 selections. When order of choice is also considered the trends noted are given further support. Thus the two blocks with cross and hole were picked out first or second 13 times, including 8 first choices. Putting it another way, 25% of the blocks accounted for 57% of first preferences. In contrast the blocks with neither hole nor cross had no first choices but four 4th choices in their total of 9. Another feature of block preference is that the four blocks with a cross accounted for 12 out of the 14 first choices.

Inadequate messages - pattern in attributes omitted

The pattern that has been evident in the choices and preference order of subjects is also present in the omission errors made when describing blocks. It was 'negative' attributes which were most often omitted and which lead to descriptions being inadequate. The findings are summarised in Table 6-6. Although 'negative' exclusions outnumber 'positive', 25 - 19, in the largest single category, size, it was the positive pole (big) which was most commonly ignored. It is clear, however, that the absence of an attribute (\bar{X} and \bar{H}) was much more likely to be missed (i.e. 18 against 5).

The probabilities given beside omission scores refer to the probability of such attributes occurring bearing in mind the earlier data on preferences. They show that the presence of two attributes, cross and hole gave rise to few omissions despite there being a considerably greater opportunity for them to occur. Although the probability of leaving out information about size was greater when the block was big, the difference is not sufficient to account for double the number of 'big' as compared to 'wee' omissions

TABLE 6-6

Distribution of omitted attributes from all descriptions

<u>ATTRIBUTE</u>	' <u>POSITIVE</u> ' BIG/X/With Hole		' <u>NEGATIVE</u> ' WEE/X/No Hole		T
	<u>Probability*</u>		<u>Probability</u>		
SIZE	14	.55	7	.46	21
CROSS	0	.59	7	.41	7
HOLE	5	.57	11	.44	16
	19		25		44

* Probability of the attribute being available for description or omission, based on the number of attributes present in the selected blocks (see text and Table 6-4)

Discussion of grouped data

It is clear that the properties of the stimulus material have had an effect on the items selected and the attributes reported. The advisability of referring to features as positive and negative is open to debate. Positive is used partly in the sense of being there, that is having a cross and/or a hole, as opposed to negative, not possessing these attributes. Yet it is also a moot point whether a block with a hole in it is more or less negative than one without a hole. Presence or Absence may have been better terms but they do not take account of the size dimension where it makes sense to talk of the positive and negative poles. Another possibility would have been to adopt the linguistic terminology marked and unmarked, as used by Wales and Campbell (1970) for example. However it is by no means clear whether a block with a cross on it represents the marked or unmarked attribute (except in the obvious sense!) For the purposes of the present discussion, therefore, the terms Positive and Negative as used above, have been preferred.

What explanation can be offered for the differential effect of stimulus attributes on performance? Some features evidently have a greater capacity for capturing attention than others. Apart from those defined, an additional element - colour of cross - may have contributed to the salience of blocks with a cross. It did not seem possible to eliminate colour, except by having the cross embossed or engraved and then an extra tactile as well as visual cue would have intruded. It may be that the colour used, red, particularly attracted attention and some children used the word red in their descriptions, but it is doubtful if there is such a thing as a neutral colour in this context. The common factor belonging to 'hole', 'cross' and 'big' is that blocks with these attributes are perceptually dominant. From the subject's point of view it certainly appears that these attributes generally have more salience, if block preference can be considered an accurate measure of this.

Of more direct interest for communication behaviour is the influence of the attributes on descriptions. It is not surprising that attributes that are not present, no hole and no cross, tend to get left out. It is arguable that when a speaker fails to mention a feature he intends the listener to understand that that feature is not present on the selected item. This is perfectly legitimate, even obvious, convention, but it does need to be spelled out to the listener if confusions are not to result. What is perhaps surprising is that size, which is always present, was omitted more than any other attribute, and that the favoured pole, big, was ignored twice as much as the negative pole.

The first thing to say is that although in one sense size is always there it is more accurately described as a relative property. It is not intrinsic to the block like the cross or the hole. It is only worth mentioning at all because some blocks are smaller than others and this can only be seen by comparing one with the other. To indicate the presence of a cross or hole the speaker has only to describe accurately what he sees on the block, but reporting the size of the block demands that the block is seen against the background of the other items. So while it has been consistently argued that a comparison process is always necessary for efficient communication, some attributes can be reported regardless of comparison while others only have meaning in a relative sense. It remains true that a communicator not taking regard of context will tend to be highly inefficient and probably ineffective. He may include a lot of detail that is irrelevant or redundant and by failing to take regard of the available alternatives he will tend to miss critical features.

As to why the attribute 'big' was omitted more often than 'wee', this may be explained, at least in part, by small blocks generally being selected after the large ones. This would tend to make the speaker

notice the contrast in size; before then, the relative properties of the blocks may not have been considered. The suggestion is that when describing the early selections, the big blocks, the subject follows the standard strategy describing only what he sees on the block itself. But when there is a switch from a big to a small block the size difference is brought to the speaker's attention sufficiently for it to be reported.

Individual performances

We will deal first with a number of children who had difficulty understanding the basic requirements or nature of the task. This was sufficient to lead to the withdrawal of two children from an original pool of eighteen. In two other cases no data resulted in Child as Speaker condition. Of the withdrawn children, one was the youngest in the sample and appeared to have no understanding of the task - his inexperience in a formal task situation undoubtedly contributed to this. The other subject eliminated made no response, which was probably due to emotional problems connected with her home situation rather than the demands of the experimental task.

It was not clear if the subjects who did not provide data when acting as speakers were unable or unwilling. Despite much exhortation from the doll Dale was completely silent until the experimenter asked him if he had chosen an elephant, hoping that an absurd suggestion might produce a response. Far from rejecting the description, however, Dale latched on to it and the only subsequent descriptive terms to be elicited from him were 'elephant', 'butterfly', 'duck' and 'number'. These may have represented the sort of idiosyncratic descriptions made by the young children in Krauss and Gluckberg's (1969) task when nonsense squiggles were used as material. The other child, Karen, would select blocks but was completely unwilling to say anything about them, again despite pleas from the doll. Her standard reply was '(I) don't know

what one (it is)'.

Some other subjects were equally, or perhaps more, confused about their role in the task but were less resistant to the demands of the doll. As an illustration of this, take the opening choice of Jamie, which is preceded by the experimenter's final instructions:

E: Choose a brick from these and put it in front of you. (Jamie selects brick). Now tell Chu-Chu all about it so that he can choose the same one,

Jamie: (4 y. 6 m.) (Looking somewhat bewildered) It one on the front.

Chu-Chu: What Jamie? What did you say?

J: One brick.

The admittedly speculative inference drawn from the videotape record is that the child had not understood what he had to do, but was sufficiently alert to pick up something from the experimenter's verbal instructions. Thus he takes 'front' from 'put it in front of you', and 'one' from 'same one'. This suggests that he recognises the experimenter's statement as a command to do something, but precisely what he is uncertain. In the absence of an alternative he tells the enquiring doll what he can remember of the Experimenter's 'message' to himself, but his version of that is garbled and very abbreviated. Further requests for information by the doll lead to Jamie giving relevant, if not always adequate, messages.

Paul provides a particularly fascinating example of the way the communication situation can probe children's thought and understanding. The experimenter has repeated the instructions a number of times in an effort to make clear to Paul what is required.

Chu-Chu: Can you tell me about it, Paul?

Paul: (3 y. 10 m.): (sighs deeply)

C: What does it look like?

P: (To E) Will I show him?

E: No, you tell him. He can't see it, he just wants you to tell him about it.

P: (stares upwards, as if in thought, but makes no response)

C: Can you tell me something about the brick, Paul?

P: When I choose a wee brick or a big brick put it in the box.

Here Paul seems to indicate quite explicitly his understanding of the task, namely to choose a brick and put it in the box. The doll is to do this as well, but he does not connect the doll's action with his own, or appreciate that it is dependent on a description of his (Paul's) choice of brick. In terms of Piaget's theory Paul's thought is rooted in action; he does not seem to consider the idea that he might reflect on his actions and communicate them to another. The obvious and perhaps only way of indicating choice, for him, is to show the other person. When eventually Paul does realise that he must talk about the blocks, that is exactly what he does! His descriptions are long, rambling, repetitive, idiosyncratic, and with many irrelevancies. The requirements of the communication task do not constrain him, because he has not really appreciated what they are.

The effect of the doll on performance.

What grounds are there to support the idea that the talking doll might encourage effective communication behaviour? The overall impression gained was that the children were concerned to see that the doll had sufficient knowledge to enable him to play the game. Apart from the exceptions already mentioned (and one other, Elizabeth), the children readily took on the role of task supervisors. This role was familiar to them and just as they had been willing in the past to point out semantic errors on the part of the doll, so on this occasion were they willing to act as instructors. As a motivational force the doll was undoubtedly successful, exemplified by the children who although having an unclear

idea of the task persisted with remarkable dedication until finally achieving a tolerable degree of success (e.g. Jamie, Paul).

In others, communication resembling the genuine two-way interaction of mature subjects was present. This was indicated, in some cases, by the way information was given. Clare, for example, said to the doll in her second trial, 'Have you got a big brick with just a redabbit and a hole?' It is not so much that this message is adequate in one description, and without irrelevancies, as the form the message takes: it is an enquiry - 'Have you got?' - signifying that she has fully appreciated that the doll must look for the one that resembles her choice. The question form seems to be a recognition on the part of the speaker that the listener is an integral part of the communication network. This important realisation was much less noticeable in the earlier studies.

A different type of example is provided by Linda. She has failed to say anything about the presence or otherwise of a hole in the selected block, though the doll has tried to obtain further information. Eventually the doll is obliged to 'guess' and says:

C: Well maybe it's that one

Linda (4 y. 11 m.): Yes it is that one (putting hers in box). No hole.

(pointing to centre of block and then looking across at doll).

C: Oh. (the doll is able to change his selection with this additional information and make the correct choice)

L: (To E who puts the doll's choice in the box) Has it got two crosses on it?

It is argued that this type of exchange indicates a deeper understanding of what the communication task is about than this subject had displayed hitherto. Linda appears to be aware that achievement of the goal - to have the listener select the same block as the speaker - is dependent on the information she supplies. She only notices at the last moment that

the absence of a certain attribute, 'hole', could have a bearing on the doll's selection. She says this without having seen the doll's block and it could be that in taking the block from the array and placing it in the box, her attention is directed for a moment to the other blocks, some of which have holes, and this causes her to provide the critical extra detail. Asking the listener about his selection after he has made it is the sort of behaviour that may often occur in mature communication.

Another feature of the relationship between the child and the talking doll was the way in which the child used the experimenter to support his or her position on occasions. Many children seemed to view the relationship as one ⁱⁿ which they and the experimenter were in some sort of benevolent conspiracy to help the talking panda with its problems. Very often the child would talk about the panda as if it was not in the room or as if it would not understand the level of the dialogue between 'big' people. Some examples of the child engaging the experimenter as an ally are given; firstly two from Anna. In the first extract she has selected a small brick (LXH) and has given information about the size and cross.

Anna (3y. 10m.): (sighs) Put it in the box.

C: I don't know which one it is yet.

A: A stripey one.

C: Yes. It's a small one.

A: Yes.

C: Can you tell me any more about it?

A: (sighs - hand to mouth. Looks at E.) What is there about it again?

In the second selection (BXH) she again provides prompt information about the size and cross. Chu-Chu then asks:

C: Anything more?

- A: Mm ... (hand to mouth) I'm just gorma think (Not looking at brick).
- C: Yes.
- A: I've .. (picking up brick and showing it to E.) Peter, is there anything more about this brick?

The third example comes from Lee. She selects L \overline{X} H.

Lee 5y. Om.); The wee one with the hole.

- C: The wee one with a hole. Yes. Can you tell me some more about it?
- L: (Looks at E, somewhat surprised)
- C: I'm not very good at this game. It's a wee one ...
- L: That's all it's got - a hole.
- C: That's all it's got?
- L: (turning to E). Eh, Peter?
- E: Yes that's all it's got.

In the first two examples the child believes she has exhausted the features of the blocks and turns to the experimenter for assistance when the doll persists in asking for more information. It seems to be a ploy for terminating the exchanges between herself and the doll. She seems to be indicating that she has done all she can and unless the experimenter can offer anything else, the doll must make a decision on the basis of the information provided. Her concept of 'thinking' is rather comical, but revealing. She either puts her head in her hand or else stares up at the ceiling. What she does not do is take the logical course of action of re-examining the blocks to see if anything has been omitted. She is possibly going through a ritual she has seen others engage in, what Piaget would call a case of simple imitation, where accomodation occurs but little or no assimilation.

The older child, Lee, has not reported one of the attributes in her description, a negative feature - the absence of a cross. She is

surprised when the doll wants more information, indicating that she has not appreciated that her message has not discriminated her choice from the small block with a hole and a cross. The second part of the message: 'That's all it's got - a hole.', although not mentioning the absence of a cross does by implication signify there are no further distinguishing features. When the doll appears to question this, Lee turns to the experimenter for corroboration, 'Eh, Peter?' being translated as 'Isn't that right, Peter?'

Reporting the message - variations in technique

In describing these series of studies some attention has been paid to the manner and content of the speaker's messages: Such things as the order of report, the adequacy of the message, the number of redundant features, the number of irrelevant properties mentioned, the repetitiveness of the message and the general clarity of the description including semantic anomalies or confusions. It has been pointed out more than once that the communicative effectiveness of children of this age suffers because of excessive 'noise' accompanying the signal. It was of interest to know if the talking doll had affected the behaviour, since the hypothesis under test was that the experimental condition would lead to some adaptation on the part of the children.

Message adequacy is the ultimate test of good communication, and the general results have been given earlier. Examination of the individual records shows that some subjects consistently omit one attribute. Thus, Scott, Christine and Clare usually omit the size attribute, while Elizabeth always leaves out details about the hole attribute. Other subjects, notably Alan and Jamie, show omissions on all three attributes.

The reasons for omissions vary. When one attribute is consistently left out it may be because that attribute is not perceptually salient to the subject, but this is little more than another way of saying it does not get reported. In the case of the size attribute it has already been

argued that this is a relative rather than inherent property of the material, and this can be said of all the so-called negative features. It is only reasonable to talk about an object not having a property in relation to those objects which do have that property. It would, for example, be considered bizarre to say of any of this set, 'The block without a picture of the Queen on it'.

Another possible reason for failing to report some attributes is that the child does not describe the block in a systematic way. Here are some examples of speaker's messages.

1. Nicholas (4y. 3m.) I've picked a wee one with no holes except two crosses.
2. Lee (5y. 0m.) It's a wee one with a crosses on it and a hole.
3. Nicholas I'm gonna choose the ... big one.

Chu-Chu: The big one. Can you tell me some more about it?

N: Yes. The one with the red crosses.

C: The big one with the red crosses?

N: Yes, not with a hole.

4. Linda (4y. 11m.) There's one cross there and one cross there, and one cross there.

C: It's got crosses on it, yes.

L: And the block has a hole.

C: It's got a hole in it, yes.

L: And loads o' wood (?).

C: And wood, yes.

L: And it's a wee small brick.

5. David (4y. 1m.) This one. I'll tell you all about it. It's made with a 'X' and it's got a hole in the middle.

C: It's got an 'X' and it's got a hole - yes.

D: Why has it got a hole?

C: Can you tell me some more about it?

D: I'll tell you more about it. It's a round hole and you stick a finger in it sticks on, doesn't it?

C: It's got an 'X' and it's got a hole.

D: Yes, and if you stick a finger in, see ...

C: You can get a finger in it. Oh well, it must be that one.

6. Alan (5y. 1m.) It's just square (tracing finger round edge)

C: Yes

A: And square here and there (indicating top and bottom of brick.)

C: Can you tell me some more about it?

A: Just square - squares.

C: It's just square. I'm still not sure which one it is

Alan. Can you help me some more?

A: Uh Huh. It's all white.

C: It's all white, oh, and it's square. Can you tell me any more about it?

A: Yes .. no.

7. Gregor (4y. 7m.) Mine (?) got a cross on the other cross.

C: Tell me about it Gregor.

G: Mine got a cross and (on?) a other cross.

C: A cross on the top. Can you tell me some more about it?

G: Thellow (yellow?) er, em ... there was one going down and there's one going up, again.

C: There's one going down and one going up a bit.

G: Yes and there's one going up and down and one going down. That was Two?

C: Can you tell me some more about it Gregor, I'm not very good at this game.

G: (Mumbles something) I don't know.

The first two examples are illustrations of efficient communication

where the critical features are reported clearly in one fairly brief message. In Example 3 the information is again to-the-point and is given this time in three messages with a degree of interaction between speaker and listener. The same broadly goes for Example 4, though here there is some redundancy (crosses) and irrelevancy (wood). By repeating the information after each message the listener helps to direct the speaker to the task at hand. In Example 5 David includes two critical attributes in his opening message, but then seems to get centred on the properties of the hole. Although requests from the listener do not cause David to notice the third critical feature, he does provide a clue about size, presumably inadvertently, by saying he can get his finger in the hole.

All of the examples, 1 to 5, represent messages which provide sufficient information for the listener to make a correct selection, though the effectiveness varies. An example not quoted since it takes up more than a page of transcript, comes from the record of Anna. For her second block fifteen discrete utterances are required before the doll is able to make a choice. Many of these utterances are irrelevant to the task and others are repetitious, though finally enough information is available to allow a correct selection.

This does highlight a very important difference between the talking doll as a listening partner and another child of pre-school age. Although the doll is presented as an *ignoramus* who needs patient assistance from the child, the role which the doll does in fact play is much more positive than might be assumed. A four year old child, for instance, would not normally be able to maintain the support and attention which the doll shows, sometimes in the face of excessive repetition, silent withdrawal or obscurity. The argument that the child might provide more help for the talking doll because it represents a known poor performer may now seem dubious. But the weight of the evidence in this and earlier

experiments, continues to support the idea that the doll is seen as someone in need of help - a slightly pathetic figure even to a few - and that it is this which is having a decisive impact on performances.

Example 6 depicts a generally unhelpful message. The word 'square' is applied to all the blocks, and the subject seems dominated by shape. Later he says 'it's all white' which suggests the absence of a cross, but the listener is unable to derive further useful information despite the subject's willingness to try and be of help. Concentration on one element is a strong feature of Example 7 also. Here the attribute is the cross and Gregor engages in the type of analytic description seen before. Even with the probing of the doll Gregor does not seem to be able to go beyond the feature which is paramount for him. This, accordingly, limits his effectiveness as a communicator in this task.

Child as Listener.

The detailed subject by subject results can be found in Appendix E. Table 6-7 shows the degree to which listeners were successful in identifying the speaker's choice of block. The 16 subjects each made four selections giving 64 trials in all, but since data for two trials are missing, the effective total, shown in Table 6-7, is 62. The top line in the table gives the number of blocks for each trial chosen by listeners - the children - which matched the selection of the doll speaker. It can be seen that 22 of the 62 trials, 35%, result in correct solutions. Translating this into communication terms it implies that on 22 trials the listeners were able to obtain sufficient information from the speaker to enable a correct choice to be made. The justification, or otherwise, for this conclusion will be discussed below.

The success rate of 35% seems low in comparison to the 83% of the child as listener to the 'Ideal' speaker (Chapter 5, Study IV), but it is difficult to relate the two studies. In the ideal speaker condition listeners were always given adequate, though not necessarily complete,

descriptions and so were not required to derive further details, as in this study. Two other differences, the size of array and the number of choices to be made, were also such as to favour the earlier task.

The figures show that most successes occur in the middle trials, 2 and 3. It is understandable that the first trial should account for more errors, but it is surprising that fewest successes are recorded on trial 4 when the pool was at its smallest and the subjects had the benefit of most experience. The group data does not allow of any explanation but it will be argued below, following examination of individual performances, that overconfidence was a factor in Trial 4 errors.

The aim of the exercise in this task was for the children to obtain enough information to make the correct block choice. A measure of this ability is the number of attributes about which the children enquired. It was so arranged that in every trial the listeners needed knowledge about all three critical attributes to determine the chosen block. Since they were always given one attribute in the doll's opening message, this left them two features to derive in each trial, giving a total of 124 (64 by 2) attributes in all. The extent to which they achieved this can be assessed from Table 6-8.

The figures refer to the number of times a particular attribute was sought - information requested about it - or not sought by the listener. Although 54 of the 124 attributes, 43%, are derived, this does not match the actual success rate of 35% because identification demands two obtained attributes per trial. In fact the picture is rather less bright than this. Inspection of Appendix E shows that in all there were 18 trials in which two attributes were sought, that is 18 out of 62 containing the type of behaviour required to achieve a correct solution. The difference between this figure and the 22 successful matches in Table 6-7, was due to three instances of the doll providing 'unearned' information which amounted to additional given attributes. There was also one trial

TABLE 6-7

Total numbers of correct (match) and incorrect choice
of block by child listener for each trial

LISTENER'S CHOICE		TRIAL				
		1 (n=15)	2 (n=16)	3 (n=16)	4 (n=15)	TOTAL
	MATCH	5	6	7	4	22
	MIS- MATCH	10	10	9	11	40
	TOTAL	15	16	16	15	62

TABLE 6-8

Frequency distribution of attributes sought and not sought
by listener's determining speaker's selected block.

TRIAL	ATTRIBUTES OF BLOCKS							
	INFORMATION SOUGHT				INFORMATION NOT SOUGHT			
	SIZE	CROSS	HOLE	TOTAL	SIZE	CROSS	HOLE	TOTAL
1(n=15)	G*	7	5	12	G	8(1G)	10	18
2(n=16)	6	G	7	13	10(2G)**	G	9(1G)	19
3(n=16)	G	7	7	14	G	9(1G)	9	18
5(n=15)	5	10	G	15	10	5	G	15
TOTAL	11	24	19	54	20	22	28	70
MEAN	5.5	8	6.3	13.5	10	7.3	9.3	17.5

*G = Given

**Figures in brackets means that total contains instance(s) where
 additional attribute(s) given erroneously.

where, fortuitously, the listener had sufficient information to make a choice after obtaining a description of one attribute in addition to the given feature. This was because the listener's previous choices meant that the message 'Big, without hole' was adequate for the block selected on trial 3.

Looking at particular attributes, it again transpired that 'size' was the feature most often neglected. It is open to question whether the attention drawn to 'size' by the doll, who as speaker twice provides this feature, is offset by the reduced opportunity for 'practice' in asking for this feature.

The group data about attributes sought, or even selections which match, provide little insight into the approach used by children as listeners to the doll as speaker. Since our concern is with the way in which the child went about securing information from a poor speaker, proper discussion must await consideration of the individual performance records.

Individual performances

Although this condition might be compared with the study where the child was paired with an ideal speaker, there were some important differences which fundamentally affected the nature of the task. In the earlier study the adult speaker provided adequate descriptions for each item selected, which meant that the listener always had sufficient information to determine the chosen object. In this study the speaker provided adequate information as long as the listener asked for it, that is if he recognised that he needed to know about more than one attribute.

The task of the listener in the ideal speaker situation remained a relatively passive one in which he related the incoming information to one of the items in front of him. The results showed (only 29 errors out of 170 selections) that such behaviour was well within the capacity of the young child. In the current task the demands were considerably

greater. None of the doll speaker's initial messages were sufficient to enable correct selection; the listener had to obtain data about two other attributes to be sure of knowing which block had been chosen. This required a more sophisticated conception of the communication task as a whole and particularly of the listener's role in the face of an inadequate speaker. An appreciation of the relationship between the speaker's and listener's parts in the task was necessary. Such an appreciation had not been investigated in such a demanding way in previous studies. Instead of just checking off descriptions about features against the features themselves, the listener had (i) to be able to see why a message was inadequate, and (ii) to decide how to go about obtaining a message that did allow a choice to be made. An indication of the capacities involved is provided below in the hypothesised strategy to be followed by an able listener in such a task.

Conception of a competent listener's strategy

(This account will be easier to follow if the set of blocks used in the task and shown on page 194 in the Method section, is available for reference.)

1. Before the speaker says anything the listener should know that all the blocks are potential candidates for selection. In the perceptual and conceptual sense they should be equally, and not in any way differentially, regarded. Every block, which means every attribute, should have an equi-probable chance of being attended to.
2. When the first message is received this has the effect of immediately narrowing the listener's focus of attention. He is able to reject all blocks not having the attribute in question, but include all those possessing the relevant attribute. To take as an example the block 'Big, with Hole and Cross' (BXH) as the speaker's first choice. As a result of the first message the listener knows that the wanted block is one of a sub-set of four big blocks. But he does not know any more than this.

He cannot determine the right block without more data and if the speaker does not provide this unsolicited, then he must ask for it. There are two further attributes involved, information about which will enable the chosen block to be isolated. Depending on which attribute he chooses to ask about, he can mentally partition the blocks into two sets. If he decides to ask if the selected item has a cross, for instance, it is helpful to think of the remaining blocks as a set of two 'with cross' and a set of two 'without cross'. The answer to the question, i.e. the speaker's next message, enables elimination of one set of the blocks still under consideration.

3. The listener should now be in a position to choose between two blocks and realise that one further piece of information is required to resolve the problem. In terms of the example we have been using he sees that the difference between the remaining blocks is that one has a hole and one has not. He therefore enquires about this attribute.

4. Depending on the content of the speaker's third message the listener is able to reject one of the blocks leaving the sole surviving block as that which must match the speaker's selection. As a final check he describes the block he believes the speaker to have chosen and, assuming agreement, places the block in the box provided.

The above model will serve as a standard of comparison in assessing the approaches of the children. We already know from their performances as speakers in this study that the first requirement, investing each block with an equi-probable chance of attention, is unlikely to be met. The children showed significant biases in their choice of blocks, and in the attributes omitted from descriptions.

The subjects fall into four categories of performance or listener types. These are summarised in Table 6-9. These groupings are by no means clear cut or mutually exclusive. Subjects who at the beginning of the task showed no understanding, might by the end have been making

TABLE 6-9

Classification of listener's performance in terms of strategies
used when talking doll is speaker (Blocks Task)

TYPE	DESCRIPTION	MEMBERS
I	Do not understand task or their role in it. Content to select block on basis of 'given' attribute. No indication that they realise the message is inadequate.	Jamie, Dale
II	Recognise they have insufficient information to determine selected block, but no strategy for obtaining further details. (Because they doubt doll's capability?)	Lee, Alan, Sally, Karen
III	Transitional group. Some awareness of demands of task in seeking further information, but limited by inability to decenter. Strategy is to get speaker's block to match <u>theirs</u> .	Nicholas, Linda, David, Gregor, Paul
IV	Evidence of systematic strategy, though some way removed from hypothesised competent listener's strategy. Errors mainly of an executive sort.	Scott, Clare, Anna, Christine, Elizabeth

some effort to obtain further information, while subjects who usually adopted a systematic strategy sometimes made a selection after the first message. The categorisation is based, therefore, on a considered assessment of each subject's performance, so that the final assignment is thought to be the most representative of his behaviour.

TYPE 1 - No recognition of message inadequacy

Type 1 subjects were content to select a block after the doll's first message. Indeed they seemed confident that they knew which one the doll had chosen, although in fact the description given applied to four blocks. Jamie's standard response was to say 'that one' and put his hand on a block which possessed the attribute in question. He did not attempt to ask for further details. In the penultimate trial Jamie indicated that he needed to go to the lavatory and when he returned the doll gave him the initial message again. The resulting dialogue was as follows.

Jamie (4y. 6m)

- Chu-Chu: Well, the one I've chosen is a big one.
- J: (No response - head in hand)
- C: Do you know which one I've chosen?
- J: (Puts his hand on BXH)
- E: Tell Chu-Chu if you know.
- J: Er - and its got holes in it - I think so (?)
- C: No. I didn't say it had holes.
- J: That one with a cross on it (points to BXH).
- C: I didn't say it had a cross on it.
- J: That one, that one - the wee ones (going through those left).
- C: I just said it's a big one. Do you know which one I've chosen?
- J: No
- C: Why not?

- J: Cos I'm been too burstin'.
- C: Oh, because you've been too bursting.
- E: Do you want to ask Chu-Chu? If you don't know which brick Chu-Chu's chosen you can find out by asking him.
- J: (N. R.)
- E: Well which one do you think it is Jamie?
- J: That one (BXH). That one (LXH)

Jamie seems happy to adopt his usual course of selecting on the basis of one attribute, but the Experimenter intervenes and suggests that he tells Chu-Chu if he knows which one it is. There then follows a series of denials by the doll of the attributes mentioned by the child. In effect the child describes the block he has selected rather than the one he believes the doll has selected, which is probably not a meaningful question to him anyway. When the doll says, 'I didn't say it had holes (crosses)' Jamie picks out different blocks in an effort to achieve some agreement. Eventually he ignores the original given attribute, big, when he points to the small blocks.

To some extent the child and doll are talking at cross purposes. The doll is not denying that the selected block has a cross or a hole, he is only saying that he has not said whether it has or not. The subtlety of this was lost on Jamie. It could be argued that the format in which the exchanges between speaker and listener ~~are~~ carried out do not allow the child an opportunity to capitalise on a possible new insight. If, for instance, when Jamie says 'and it's got holes in it' he is really asking for information and not describing the block he believes it to be, then it is the restricted nature of the experimental procedure which denies him the feedback requested. There is however no reason to think that this is what Jamie did intend, and the experimental procedure could not be flexible to that degree. If it had been, the aim of having children earn additional attributes would have been lost.

This issue and others relating to the competent listener's strategy will be taken up later. By the end of the trial Jamie seems somewhat confused and is undecided between at least two blocks. He finally settles for one that has neither cross nor hole, which may be said in his terms to comply with the doll's description, but is in direct defiance of the known attribute, big. In the final trial Jamie returned (with some relief) to his normal response of selecting solely on the basis of the initial message.

TYPE II - No strategy for obtaining additional information

The subjects making up Type II seem to realise that they have insufficient information to pick out the correct block but make no attempt to procure further details. This might have been because they did not know how to, or possibly because they considered the doll was incapable of providing further assistance. This latter proposal is speculative, but because the doll has always been cast in the role of someone with limited ability, it is plausible. This suggestion is particularly attractive to explain why two usually very able children, Lee and Sally, performed in this unproductive fashion.

The evidence, however, is somewhat thin. When Sally was asked by the doll why she didn't know which one he had chosen, she replied: 'Because I don't know whatch (sic) one it is'. When pressed by the doll to give a reason she turned to the experimenter and smiled. It may be that she was waiting for some sort of lead from the experimenter, for in the final trial when he eventually said, 'Tell Chu-Chu why you can't choose', she said 'Because I don't know whether it's got stripes or not'. Having obtained this information, however, she still selected on the basis of an inadequate description. Lee also repeatedly said that she didn't know which one the doll had chosen after the first message, but nevertheless selected blocks on the basis of limited descriptions.

Alan's general performance was one of uncertainty. He seemed to

be aware that the doll was not providing enough data but at the same time he appeared to think that he must try to select a block on the basis of that data. Although the experimenter suggested he asked the doll if he didn't know, it may be that the doll's question - 'Do you know which one I've chosen?' - was slightly/^{intimidating}for an uncertain child. He possibly took it to imply 'Why don't you know - you should do'. The extract below illustrates Alan's dilemma.

Alan (5y. 1m)

C: This one is a big one.

A: (Uncertain, N. R.).

C: Do you know which one I've chosen?

A: Uh huh. (puts hand on BXH) The one with the hole in, and it's big.

C: I didn't say that. I just said it's a big one.

A: Oh. Must be that one (switches to BXH).

C: Do you know which one I've chosen?

A: Er ... think .. (looking through the array) Yes (not confidently)

C: Do you know Alan?

A: Yes .. I think so (hand on BXH)

C: You think so, but do you know?

A: Yes.

C: Well put it in the box if you know which one it is Alan.

The point at which Alan switches his choice without having received any fresh information suggests that he has not understood the necessary relationship between the speaker's message and the listener's choice.

Karen was more straightforward. She repeatedly said she didn't know which block the doll had chosen, and that she didn't know why she didn't know. She never requested more information or made suggestions but made choices, possibly at random. It is impossible to say whether recognition of her own ignorance is seen to be due to the doll not telling her more

or the doll not showing her which one he had selected.

TYPE III - Transitional group

There is no clear defining characteristic to attach to the members of the third group. Two of its members may be said to represent a special sub-grouping. This is because they do not appreciate, at least initially, that the task is essentially a verbal one; that successful selection is not dependent on concrete visual matching but on a process of relating a verbal description to one of a series of similar objects.¹ Gregor, for example, repeatedly said that he did not know which one the doll had chosen 'Cos you've got the screen over your bricks'. Paul persisted in a similar response - 'Cos I can't see it' despite being directed to use an alternative method of securing information, namely speech. These subjects also had attentional problems which gave rise to additional handicaps, but towards the end of the task they gave some indication of having realised the inadequate nature of the original message and of knowing how to obtain more details. Here is an example from Paul's record.

Paul (3y. 10m.)

C: A big one. Do you know which one it is?

P: No.

C: Why not?

P: Because I told you ... cos I can't see it.

C: Yes but I'm telling you about it, it's a big one.

P: I know (smiles at E)

C: It's a big one Paul. Do you know which one I've chosen?

P: Has it got no lines (cross) - or lines?

C: It's got no lines.

P: No lines .. has it (?) .. no hole?

C: There's no hole.

P: This is it.

1. If comprehension of this fact is an initial requirement, the skills to carry out this operation are, of course, a necessary pre-requisite for actual achievement.

C: Oh, put it in the box if you've got it. ($\overline{BXH}/\overline{BXH}$)

Paul's use of the negative question form - 'Has it got no lines or lines?' - represents an accomplished inference on the part of a child under four. He is clearly able to express the fact that there are two possibilities involved in the situation. It also shows that the use of the negative need not exclude the positive from consideration at this developmental level. The child realises that the negative also implies the positive - if it is not a block with no cross then it must be a block with cross. In a discussion of this issue, Donaldson (1971) gives examples of questions that entertain two possible outcomes and Paul's question seems to fit into this category. In Donaldson's words Paul has an 'awareness of being in a state of ignorance'. Perhaps the most distinctive feature of this group, as a whole, is that they appear to select a block following receipt of the first message and then attempt to 'get' the doll's block to match theirs. This is clearly a different strategy to that outlined in step 2 of the competent listener's strategy, where the effect of the first message is to focus attention on a restricted but multiple number of the blocks in the array, these being the four specified by the attribute given.

Some extracts exemplify Type III behaviour.

Linda (4y. 11m)

C: This next one has got a hole in it.

L: (picks up \overline{BXH} , the only large block she has left) I've got the right one. A big one?

C: No. It's a wee one.

L: A wee one (puts down \overline{BXH} and picks up \overline{LXH}) I've got the right one. After getting the first attribute, Linda makes two unwarranted assumptions, i.e. big and no cross. It does however lead her to go on to enquire about size. Having obtained further data she fails to exhaust the attributes and hence the strategy of selecting too early leads her into

error.

Nicholas (4y. 3m.)

C: This one has got a red cross on it.

N: Is it a wee one or a big one?

C: It's a wee one.

N: It must be this one then (selects LXH)

C: Do you know which one I've chosen?

N: Yes.

C: Do you know which one I've chosen?

N: Yes. I bet it's got a hole (changes selection to LXH)

C: Do you know which one it is?

N: Yes, it's the hole one, I know.

This task leaves the onus of communication on the listener. Although it is emphasised that the child must choose the same brick as the doll, the children in this category establish the criteria themselves having been given an initial indication by the doll. Nicholas's emphatic use of the modal, 'it must be this one', is typical of this approach - the one I've chosen must be the one that Chu-Chu means. His change from LXH to LXH may not be entirely a matter of personal whim however. It may be the result of the doll's persistent questioning - 'Do you know which one I've chosen?' - which causes Nicholas to think he has the wrong one and therefore to change it. David shows similar behaviour.

David (4y. 1m.)

C: This next one has got a hole in it.

D: (Pulling large brick towards him) Well is it a big one?

C: No it's a wee one.

D: Well it must be this one (selecting a small brick and putting it in the box before exhausting attributes).

In contrast to Paul's demonstration of possibility, mentioned just previously, the behaviour of Nicholas and David seems to be a complete

denial of any possibility of doubt. In a task that asked children to say what colour a hidden object was, Le Bonniec (1970, reported in Donaldson 1971) found that some of the subjects, aged from five to eight years, stated quite flatly what colour the object is. Like David and Nicholas they gave no sign of uncertainty, no indication that there might be a different answer to the one that they provided. It seems difficult to reconcile this finding with the earlier demonstration of a recognition of being in a state of uncertainty

Donaldson (1971) has suggested that there is a natural sense of the possible amounting to a cognitive intuition, while the complete disregard for possibility, called arbitrary errors by Donaldson, may be failures due to a particular characteristic of the task situation. The fact that, in this instance, both types of behaviour have appeared in the same task situation may mean that task situations affect children differently.

These performances raise a number of questions. To what extent is a knowledge of class relations required in such a task? An understanding, for instance, that a block can be a member of the class of big blocks, the class of blocks having a cross and the class of blocks having a hole at the same time. The realisation that classes can overlap to form a logical multiplication is said by Piaget to be acquired in the concrete operational period and is therefore unlikely to be present in the majority of children in this sample.

Another related problem concerns the difficulty for the listener of asking about a single item while focussing on a set of items. The listener must simultaneously have in mind that he is looking for one block - and must ask questions about one block - while utilising any information received to make decisions about a group of blocks. This, at least, is the hypothesised strategy for the competent listener but the child seems to adopt a different approach. Certainly Type III children selected a single item much earlier than would a competent

listener - in many cases after the first message. For some children this might have been due to a basic misconception of the task. But since the majority go on to ask further questions, indicating they are aware of the need for more detail, another explanation is needed. It is possibly an adaptive procedure used by younger subjects to limit the information flow to manageable proportions. Once they have isolated a particular item it becomes possible to ask for further relevant information and process the incoming data efficiently. Our limited knowledge of the information processing abilities of the immature system (Belmont and Butterfield, 1969; Clifton and Bogartz, 1968; Rhandhawa, in press) suggests that there is a lower tolerance of ambiguity and a narrower information channel capacity.

Although the approach outlined above may be useful in dealing with information input generally, and may indeed be instrumental to success as a Speaker, in this type of task, there are possible maladaptive consequences for the listener. With his attention confined to one block, he will check off attributes against the chosen item but not for the rest of the pool. Suppose the sequence was as follows.

Speaker: It is a big block.

Listener: (Selects $BX\bar{I}$) Has it got a cross?

S: No.

L: (Discards BXH and selects $BX\bar{H}$) Has it got a hole?

S: No.

L: It's this one - ($BX\bar{H}$)

What will seem particularly bizarre is for the listener to discard BXH , after being told the chosen block has no cross, and then to pick up another block ($BX\bar{H}$) with a cross. This may happen, however, if the listener is confining messages received to his own selected block and not extending the property 'no cross' across the set. It is being postulated that an ~~internal~~ argument something like the following is

going on: 'It isn't this block because this block has a cross, so I must choose another block'. The immediate goal then becomes that of choosing another block. The fact that the next block chosen has a cross ($B\bar{X}\bar{H}$) is, it is argued, a matter of chance, but this is not true of the attribute 'big' since this was the original premise on which he based his initial selection, and so it carries over to his second selection. The listener continues to base his questions and assessment on the chosen block and so comes, erroneously, to settle for $B\bar{X}\bar{H}$ instead of $B\bar{X}\bar{H}$.

There are no examples among the children in the third group corresponding to the behaviour postulated above, but the extracts given earlier indicate that the general thesis holds. Another excerpt from Nicholas's record provides a particularly fascinating example of a child trying to 'escape' from the handicaps which his own limitations (i.e. unwarranted assumptions) are in danger of placing him.

Nicholas 4y. 3m)

Chu-Chu: This one is a big one Nicholas.

N: Right (puts $B\bar{X}\bar{H}$ and $B\bar{X}\bar{H}$ together).

C: Do you know which one it is?

N: I bet it's not got any red crosses or holes.

C: Do you know which one I have chosen?

N: It must be this one (picks $B\bar{X}\bar{H}$)

-
1. Such behaviour is reminiscent of that described by Vygotsky (1962) in his analysis of concept formation using a classification task with blocks varying on a number of dimensions. In particular the subject at the stage of what he calls the pseudo-concept, although appearing at first to classify objects in a systematic way, is not likely to draw the appropriate conclusion when it is pointed out that a particular selection is unjustified. Instead he will discard that particular choice but continue to include other exemplars with the same 'incorrect' attribute. (See Vygotsky, op. cit. p. 67 and also examples in Chapter 5, Study IV of this work).

C: Do you know which one it is?

N: Yes.

E: Why? Tell Chu-Chu why you know.

C: I said it's a big one.

N: I've got ... I've got one big one, two big ones, three big ones,
I've got.

C: Oh .. this is a big one with no cross.

N: It must be this one (looks at E) I've chosen the one you said
Chu-Chu.

C: Oh, put it in the box then. ($\overline{BXH}/\overline{BXH}$)

Nicholas's first reaction is close to that proposed as the optimum procedure. He picks out the blocks which answer to the description so far given - 'big'. But he only picks out two, instead of three, big blocks. But his next response implies that he has settled on one of these blocks as the selected item - \overline{BXH} . He follows this up when asked again by indeed picking out \overline{BXH} and saying 'It must be this one.' It is difficult to know the significance of the modal form - 'it must be'. If it indicated that the subject was sure of his choice because consideration of the data led to such a conclusion then one must say simply that the deduction and resulting conviction was spurious. But it may have been a way of bolstering what was in fact uncertainty on the part of the listener, giving him confidence in his problem-solving ability.¹ But then an interesting change takes place. When the experimenter asks the child to tell the doll why he knows which one it is,

1. It may even amount to what some personality theorists call an affirmation of the self, an idea with which Piaget is in some agreement.

Nicholas is unsure and hesitates. The doll then repeats the original message and Nicholas responds with the 'classical' ideal listener retort: 'I've got three big ones.' He gains more information by this ploy but acts on it immediately, failing to notice this time what he had succeeded in doing earlier, that the description still applies to more than one block.

The advance made by Nicholas in realising that the doll's first message is inadequate because it specifies more than one block is carried over into the final trial.

C: I said it's a wee one.

N: I've got three wee ones. Maybe you've made a mistake this time
Chu-Chu.

C: This one hasn't got a hole in it.

N: It must be this one (LXH)

C: Do you know which one I've chosen?

N: (To E) It must be this one. (No response from E or C) Which one
is it, then? (looking hard at doll).

C: It hasn't got a hole in it and it's a wee one.

N: I bet you...

E: Do you want him to tell you any more, Nicholas?

N: Yes, If he can anyway.

C: And it hasn't got a cross on it.

N: It must be this one! (LXH/LXH)

Nicholas impressively indicates that the description is insufficient because he has 'got three wee ones.' But he once again seizes on a selection as soon as he obtains a second piece of information. When his choice is implicitly challenged by the doll he is far from egocentric in asking, 'Which one is it then?' How significant is the remark, 'Yes. If he can anyway.'? It seems to lend some support to the earlier suggestion that some children's performances may be affected

through seeing the doll as a speaker incapable of providing satisfactory descriptions. A similar tone is present in an earlier piece of dialogue between Nicholas and Chu-Chu.

C: Which one is it?

N: It's with a big cross.

C: Yes. And it's a big one.

N: Yes, I know that. I've got it in my mind. (points to head and closes eyes).

E: You think you know which one it is, do you Nicholas?

N: It must be this one.

C: If you want to know just ask me, Nicholas, because I'm not very good at this game.

N: But I am (chuckles)

Again the evidence is slight, but there is a certain patronising tone about Nicholas's remarks which might cause him to rely more on his own intuition than on help from his partner.

TYPE IV - Towards a systematic strategy

The most accomplished performers are marked by the efficiency, consistency and directness with which they go about determining the object to which the speaker is referring. This is not to say they are invariably consistent or even that they always discover the correct block; it is the fact that a recognisable plan seems to guide their behaviour and that failure is a function of lapses of attention or executive errors. On some occasions lack of success can be seen to be due to the subject 'slipping-back' into an earlier, and generally less effective, type of approach such as those discussed above. Some examples will illustrate Type IV performances.

Scott (4y. 9m.)

C: It's got a red cross on it.

S: Has it got a hole?

C: There's no hole in it.

S: Then I know what it is. Er ... there's a cross (to himself).

Is there two crosses?

C: Yes.

S: Well I've got one, is it a wee one?

C: Yes it's a wee one.

Note that he appears to be on the point of selecting a block after receiving the second message, but realises that more information is required. Note also the redundant question, 'Are there two crosses?' All blocks with cross have two crosses - top and bottom. Clare is another subject who enquires systematically first about the cross, then the hole, then the size, depending which attribute is given by the doll in his initial message.

Clare (3y. 11m.)

C: This is a big one.

Clare: Has it got a red cross on it?

C: No, it hasn't got a cross on it.

Clare: Has it got a hole.

C: No, it hasn't got a hole.

Clare: (BXH/BXH)

The child rejects the blocks ruled out by the information as it comes in. She eventually selects the brick that survives by a process of elimination as outlined in the competent listener strategy. What is particularly interesting, however, is that Clare did not have this strategy ready-made at the start of the task. Her reaction to the first message in Trial 1 was as follows:

C: The first one I've chosen, Clare, is a big brick.

Cl: (Looks at array, hand to mouth. No response).

C: Do you know which one I've chosen?

Cl: No.

C: Why not?

Cl: I just don't know.

C: Why do you not know which brick I've chosen?

Cl: I just don't.

She is quite emphatic that she doesn't know which brick it is, markedly different from Type I and II subjects, but she does not know at this point how to go about discovering the identity of the block. Then the experimenter repeats the relevant instruction.

E: Do you think Chu-Chu can help you any more?

Cl: (Nods).

E: Would you like to ask him anything?

Cl: Has it got anything else on it?

C: It's got a red cross on it and it's a big one.

Cl: Has it got a hole in it?

She realises that the solution to the problem is in her own hands, i.e. by asking the right questions. It is significant that she believes that Chu-Chu is able to help her further. She thus gives evidence of an ability to put herself in the position of the speaker with all the information at his disposal. If egocentrism of the kind described by Piaget is a limiting factor in this task, it does not seem to be present in this subject. Having discovered the way to obtain further information, Clare confidently uses this procedure in the later trials as illustrated earlier.

It is a truism that the more two-way interaction there is between speaker and listener, the more successful is understanding likely to be. When messages are ambiguous or incomprehensible there will be no progress towards meaningful communication without further dialogue. One of the main reasons behind the success of one subject in Group IV, Anna, was that she had always had a close relationship with the doll. She did not talk at him but to him, which meant that when she wanted to know something

she needed little encouragement to ask. After the experimenter had explained the task the record went as follows:

Anna (3y. 10m.): Well, which one is, I .. er em .. is Chu-Chu gonna choose?

C: The first one I've chosen is a big brick.

A: (No response. Looks at doll).

C: Do you know which one I've chosen?

A: (Nods) What one?

C: It's a big brick.

A: And ... has (?) it got stripes on?

C: Yes, it's got stripes on it.

A: Not a hole?

C: It's got a hole in it. Have you got it?

A: Yes (BXH/BXH)

Anna continues to use a systematic strategy and even asks for information about two attributes in one enquiry on Trial 3.

C: This is a big one.

A: Has it got no hole and no stripes?

C: It's got no hole and no stripes.

A: (Makes choice)

C: Have you got it?

A: Yes (BXH/BXH)

Anna's performance represents genuine cooperative communication, carefully attending to the doll's statements, asking questions and checking off the information against her array as she receives it.

Despite their obvious proficiency three of the Type IV subjects, Clare, Anna and Scott, made errors on the final trial. This was surprising for two reasons. Firstly, they had had practice at achieving an effective strategy and success at using it, and secondly the pool of blocks is reduced by three for the final task and therefore selection should have been correspondingly easier. The cause of their errors

appears to have been overconfidence or over-enthusiasm. Where they were prepared to be steady and methodical earlier, they are later betrayed into mistakes by choosing before they have all the necessary information. As often happens when a task becomes well practiced and apparently easier, executive errors or slip-ups can creep in. The only subject who totally avoided errors was Christine. Her strategy, however, was not as clearly advanced as that used by the other children of Type IV. To indicate the approach used by Christine a lengthy extract is required.

Christine(3y. 9m.)

Chu-Chu (C-C): The first one I've chosen is a big brick.

Christine (C): (Looks along array apparently examining the big bricks and selects BXH and shows it to E).

C-C: Do you know which one I've chosen?

C: I've chosen ... I think the one it is.

C-C: Do you know which one I've chosen?

C: Mm ... I don't know.

C-C: Why not?

C: Cos I think it's right .. that .. the one I've chosen.

C-C: Why do you not know?

C: Cos ... I can't see your bricks, and I can't see which you choosed.

C-C: Yes but I told you about it; I told you it's a big brick.

C: What kind did you say?

C-C: I just said it's a big brick.

C: You've got to say more than that (conspiratorial smile at E).

C-C: You need more than that?

C: Yeah, you got to say more.

C-C: Well, it's got red stripes on it.

C: So has mine. And mine's got a hole in the middle.

C-C: I didn't say that, I said it's a big brick with

red stripes.

C: You've got to say more than that.

C-C: Well, it has got a hole in it. Do you know which one I've chosen?

C: No.

C-C: Well, it's a big brick with red stripes and a hole in it.

C: And grey bits on the side?

C-C: Yes.

C: I've got the same as that.

C-C: Well put it in the box.

Christine was using a Type III strategy when she selected a block on the basis of the first message. She adopted this procedure in each trial and there are grounds for including her under Type III. The reason for not doing so is that she consistently indicated that she had not enough information until descriptions of all three attributes were provided. Furthermore she was always prepared to change her selection on the basis of new information. Her tactic for gaining more detail was the unorthodox one of saying 'You've got to say more than that'. This meant that the strict requirement of asking about specific attributes was not met. The tendency to try to get the doll's block to match hers, shown clearly in the excerpt above, indicated a basic misconception of the task. Christine demonstrates another aspect of the task, shown also by Clare. When they had all the information necessary to make a choice, the children still said they could not choose. This might have been due to a storage problem when details had to be retained over a fairly lengthy time span, interspersed with other, sometimes irrelevant, input. When the full adequate descriptions were repeated correct identification was completed.

Summary

Communication tasks between young children showed that an adequate appreciation of the speaker and listener roles was not present. When paired with an adult providing an 'ideal' speaking or listening partner, performance improved significantly indicating that, given discriminating messages and appropriate feedback, successful communication behaviour was possible on the part of pre-school children. The current study sought to increase knowledge about the young child's communicating abilities by using a method which allowed scope for the child's own individual approach without sacrificing the control exercised when one half of the input was determined. The talking doll was thought to represent this compromise position between the unfettered situation of two small children discoursing - often to little purpose - and the somewhat hide-bound arrangement where the adult guided the course of the interaction.

The task was so arranged that considerably greater demands were made on the children concerning their comprehension of the communication procedure. It was also hoped that the use of a partner whose verbal and general intellectual abilities were known, by the children, to be limited would throw some light from a different angle on the so-called egocentric nature of children's language.

The main findings were as follows:

1. The doll was a powerful motivating force. Even children with limited understanding stuck to the task well.
2. As far as it was possible to judge, the doll was a positive factor in inducing effective communication. Unadaptive (egocentric) speech was minimal and signs of genuine communication were question forms, prolonged two-way discourse, and use of the experimenter in support of arguments.
3. Messages became shorter - i.e. fewer utterances per description - as number of alternatives decreased, when children were acting as

speakers.

4. Number of critical attributes reported remained constant across trials.
5. The material seemed to affect both choice of blocks and attributes omitted in descriptions. The most 'interesting' blocks visually - large, with cross and hole - were selected and absent properties tended not to get reported.
6. Size was the dimension most often left out of speakers' messages. It was thought that this was because it was an attribute depending on a comparison process for perception.
7. Examination of individual performances revealed a wide variation in efficiency of message transmission. Apart from the already known interference of repetition and irrelevance there were found to be individual differences in attributes omitted.
8. Some subjects suffered from a marked inability to decenter, with one attribute being reported at length to the detriment of others.
9. A strategy was proposed for a competent listener. This suggested that the children would be handicapped by (i) attentional bias towards certain attributes, (ii) difficulties in making a selection of one block while necessarily making decisions about a set of blocks, (iii) limited knowledge of class relations.
10. The findings suggested that (i) and (ii) above, were significant factors. The data did not allow any conclusions to be drawn about (iii).
11. Listeners' strategies were classified according to four types, (I to IV). I had no real understanding of the task and were happy to select on the basis of one attribute. II were not happy to select on the basis of one attribute but did so, apparently for lack of a rule for obtaining more information. A disbelief in the doll's ability to provide the wanted information was a possible explanation for some subjects behaviour.

III usually sought more details but often failed through making premature selections and attempting to get the doll's block to match theirs. Their remarks indicated that they did not appreciate the causal relationship involved.

IV could be described as using a systematic procedure in which executive errors sometimes intruded.

Communicating with a talking doll - 2. Spatial relations as a critical attribute.

It has been seen that the four year old child can readily discern and communicate differences in shape, size and colour. He can also tell when something is there or not there. It was of interest to know how these children might handle a more abstract dimension where the critical attributes were not intrinsic to the features themselves but depended on the relationship of the features. As has been discussed size requires a comparison process for its perception, and size was a dimension included in the current task. The other variable dimension to be used was the spatial relationship of the constituents, in this case coloured squares on a white card.

Take for example the discrimination involved in Figure 6-2.

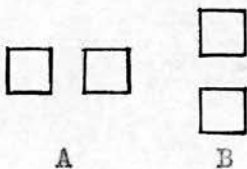


Figure 6-2

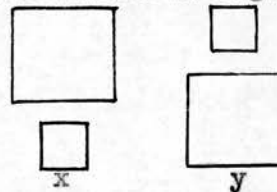


Figure 6-3

Since both items have two squares which are of the same size and colour, it follows that shape, number, size and colour are not differentiating features. In the communication situation it would be necessary to say something about the spatial alignment of the squares if the listener was to know which one was being named. If 'A' was the target item a message including a term like 'next to' or 'beside' would be sufficient, and for 'B' reference would need to be made to the fact that one was 'above' or 'below' the other. In Figure 6-3 it would not be helpful to establish the plane in which the squares were set since this is common to both. Here the exact relationship between the big and small squares needs to be described. We need to know which one is at the top or the bottom, (but not necessarily both). Another way to describe this adequately would be to talk about the big square being above the little

square.(in the case of 'x').

Visual spatial discrimination in young children is an established research field, much of the impetus being given by its assumed importance in learning to read. The field has been well reviewed by Gibson (1969). This tradition has not been concerned to examine the relationship between the discrimination of spatial relations and verbal terms used to describe them.

Piaget and Inhelder (1948) have made a detailed study of the development of children's ideas about space; they describe the emergence first of a topological stage where categories tend to operate according to the Gestalt laws such as proximity, continuity and closure. This gives way to the second stage in which ideas of projective space and Euclidean geometry appear and the relations between component parts of the spatial field are perceived. It is only then that the child is able to comprehend adequately such concepts as above and below, left and right, before and behind.

Asso and Wyke (1970) have looked at the comparison between visual discrimination of spatial relations in line drawings and verbal instructions about those relations. They found that visual discrimination was significantly superior to verbal comprehension in the three age groups tested, (5, 6 and 7 years) and that significant improvements in both occurred over this period. Their findings supported Piaget's position that an understanding of the spatial relations between objects does not appear until about the age of 7. It follows that consistent verbal comprehension will not be present until after this since Piaget's view, broadly speaking, is that language reflects conceptual development.

The opposing Russian view is that language has a predominant role in structuring the perception of spatial relations. Zinchenko and Kontseva (reported in Zaporozhets and Elkonin, 1971) conclude from their investigations "that children three - four years of age understand

quite well .. the relation 'over' and 'under'". 'Over' was a word used specifically by Asso and Wyke and they found that the success rate of a group with mean age 5 years was only 15 per cent, and had barely reached 70% at 7 years. In their discussion they remark on the lack of support in their findings for Soviet theory.

A major difference between the studies of Asso and Wyke and Kontseva concerns the experimental approach. The British workers used relatively abstract material and asked the children to pick out one item from a series according to the instruction, e.g. 'Show me the card in which the ball is over the line.' The Russians have used more naturalistic situations, e.g. 'Put the checker-piece under the table', but no details of their procedure seem to be available in translation.

The study to be reported here makes no claims to be a follow up to the work mentioned but some discussion of the effect of different methodologies on the acquisition of spatial terms will follow the account of the main experiment. Relatively abstract material was preferred for the communication task for the following reasons:

1. It was thought that this would demonstrate the spatial relationships in the least ambiguous fashion.
2. Its convenience for the task as devised, where identical sets of easily handled items were required.
3. The need to avoid material with many superfluous or distracting features - i.e., an attempt to control the signal-noise ratio.

The pool of cards used demanded that the subjects reported the size of squares used, the orientation they were in (horizontal or vertical) and in the case of some items, the precise spatial location, i.e. which was at the top, which was at the bottom.

As in the first experiment with the doll, all the subjects took the part of speakers first. A difference was that the experiment was split into two sessions, the second being where the doll acted as speaker.

The conventions used by the doll in the roles of speaker and listener which were successfully employed in the first experiment were used again.

The basic aim was to see how children who had shown they could cope with quite sophisticated objects containing up to three critical features would handle stimuli which required the use of more abstract terms, again using the doll as a sympathetic and motivating partner to whom they should direct their efforts

Method

Subjects

Thirteen children, six of them male, with ages ranging from 5 years 1 month to 3 years 10 months, took part. Mean age for the group was 4 years 4 months.

Materials

Two identical sets of seven cards (9 cm square) with squares of blue paper of two sizes, BIG (3 cm), LITTLE (1.5) mounted on the cards in a central position as follows: BIG above LITTLE ($\begin{smallmatrix} B \\ L \end{smallmatrix}$), LITTLE above BIG ($\begin{smallmatrix} L \\ B \end{smallmatrix}$), BIG beside LITTLE (B L), BIG beside BIG (B B), LITTLE beside LITTLE (L L), BIG above BIG ($\begin{smallmatrix} B \\ B \end{smallmatrix}$), LITTLE above LITTLE ($\begin{smallmatrix} L \\ L \end{smallmatrix}$). They are illustrated below, Figure 6-4.

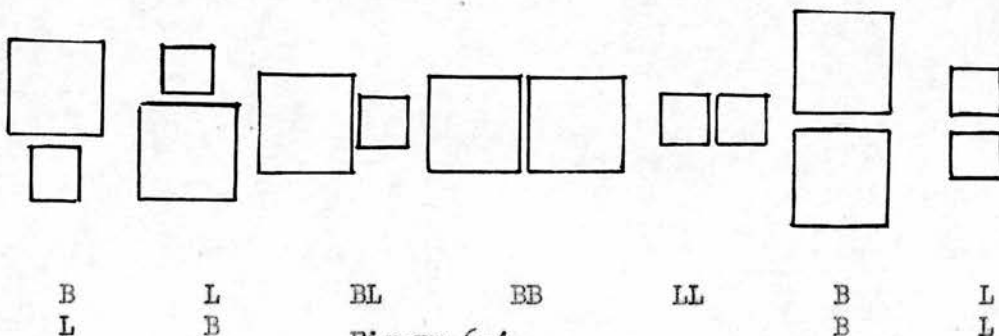


Figure 6-4

Procedure

The standard procedure described in the blocks experiment was used. The subject was shown his set of cards and then shown that the doll's cards matched his own. Screens were then put up so that the

participants were only able to see their own cards. The experiment was run in two parts. In part one the child acted as speaker and described chosen cards, one at a time, so that the doll could choose the same card. In part two the child was the listener while the doll described the cards. In each session four out of the seven cards were described.

The instructions for the respective parts were as follows.

Part one - Child as Speaker. After child had been shown that the two sets of cards were identical, by matching them: 'Now let's see how clever you are,, at telling Chu-Chu about your cards. Listen carefully Chu-Chu because is going to tell you about a card he has chosen to go into the box. See if you can choose the same one.'

Doll: Yes, I'll listen to what tells me and see if I can choose the same card.

E: Now,, choose a card. Put your finger on it, but don't move it yet. Tell Chu-Chu about it so that he can choose the same one as you.'

If the child's initial description was inadequate the doll would say 'Can you tell me some more about the card, ...? I don't know which one you mean.'

If the description was still inadequate, the doll repeated the description by the child and said: 'I'm not very good at this game, ..., I still don't know which one to choose. Can you tell me some more about it?' If still no help from the child: 'Well, I'll have to guess, perhaps it is this one'.

When the child's description was inadequate, care was taken that the doll's choice did not match the child's.

Part two - Child as Listener

E: We're going to get the little cards out again, and this time Chu-Chu's going to have a turn. Will you help him? Now ... you listen carefully to Chu-Chu because he's going to choose a card

and tell you all about it. See if you can choose the same one. If you don't know which one Chu-Chu's chosen, see if you can find out by asking him.

The doll's initial messages which were always inadequate, were as follows:

Trial 1. Big square and wee square.

Trial 2. Two wee squares.

Trial 3. Two big squares.

Trial 4. A big square and a little square.

The doll provided the additional information about spatial distribution as long as the child made it clear that he needed such information. The type of feedback which qualified for more detail is comprehensively set out in Table 6-13.

Child as Speaker

Results and Discussion

Group Data

The data will be treated and discussed under three headings:

- a) Message adequacy and omission of attributes.
- b) The effect of material on selection and description.
- c) An analysis of words used to describe spatial relations.

Message adequacy and omission of attributes. 13 children participated in the experiment but one showed no interest in the task and declined to describe any cards. Each of the remaining 12 children chose and described four cards except one subject (Anna) who wished to terminate the session after three selections. (I'm tired of playing the game now). For some children, at least, it was clear that this material held little interest for them. Anna made this very obvious when she said, 'Well I think the next day we'll have different ones with animals.' In the majority of cases the presence of the talking doll compensated for the dullness of the material.

Table 6-10 shows that of the 47 trials only 12 contained adequate descriptions. An adequate description in this task usually required that the speaker provided information about the size of the squares, the orientation or plane in which they were set, and, in the case of different-size squares, the position of one in relation to the other (e.g. big above little). The data on attributes omitted shows why so few adequate descriptions resulted. The first critical feature, size, was only missed out twice, but the plane in which the squares are set was omitted in 31 of the 47 trials (68%). The reason why the 16 references to plane did not all lead to adequate descriptions, is that position, or very occasionally size, was left out. Position was a critical factor in 15 of the trials and so its level of omission (73%) was even higher than that for plane.

The explanation for the almost invariable reporting of size in contrast to its frequent omission in the blocks study would seem to be due to two factors. In the first place the necessary contrast (Big/little) was provided within three of the cards. In the previous task it was necessary to compare the selected block with other blocks to perceive the size difference. The second factor was that, although four of the items contained squares of the same size and therefore no contrast was present, because size was the only obvious and easily described varying feature it was always reported. In the blocks task there were other more dominant variations.

To sum up then, the speakers messages were generally unhelpful because they failed to include information about the orientation, horizontal or vertical, in which the squares were lying and, when relevant, the position of large relative to small squares.

Effects of material on choice and description. Table 6-11 shows that choice of card was not uniformly distributed across the seven items. The vertical same-size squares, $\overset{B}{B}$ and $\overset{L}{L}$, were the most popular selections

TABLE 6-10

Number of adequate descriptions and attributes for each child when speaker

SUBJECT	ADEQUATE DESCRIPTIONS	ATTRIBUTES OMITTED		
	(Maximum = 4)	Size	Plane	Position
Alan	0	2	0	2
Lee	4	0	0	0
Linda	3	0	2	0
Scott	1	0	3	1
Gregor	0	0	2	1
Elizabeth	0	0	4	1
Paul	2	0	3	1
Anna (n = 3)	0	0	3	1
Sally	0	0	4	1
Nicholas	2	0	2	1
Christine	0	0	4	1
Clare	0	0	4	1
	12	2	31	11

TABLE 6-11

Distribution and order of individual card choice and preference for plane and size based on weighted totals.

TRIAL		CARD							
		B L	L B	BL	B B	L L	BB	LL	TOTAL
1		0	2	1	3	2	2	2	12
2		2	2	0	1	4	2	1	12
3		1	2	3	0	2	2	2	12
4		2	0	0	3	2	2	2	11**
TOTAL		5	6	4	7	10	8	7	47
WEIGHTED*		10	18	10	18	26	20	17	MEAN
CARD TYPE	VERTICAL PLANE	10	18		18	26			18
	HORIZONTAL PLANE			10			20	17	15.7
	SAME SIZE				18	26	20	17	20.25
	DIFFERENT SIZE	10	18	10					12.7

*Weighted totals giving 4, first choice, (Trial 1) down to 1 for fourth choice

** Total is one short as one subject completed only three trials

and this difference is highlighted when totals are weighted to take account of order of choice. The lower half of table 6-11 gives number of selections (weighted) as a function of the two major variables, plane and size. It can be seen that a majority of children preferred cards that had same size squares in a vertical orientation. To see if the most marked difference, size of square, was significant, subjects were scored according to the number of same-size and different-size squares they had selected. The scores took account of order of selection and were equated for the number of choices available, i.e., there were more same-size squares in the set. A Wilcoxon matched-pairs signed ranks test indicated that although 9 of the 11 subjects showed a preference for same-size squares, the difference shown in Table 6-11, 20.25 against 12.67, was not significant ($T = 14$, $p. > .05$). The number of adequate descriptions was too small to see whether some card types were more likely to yield errors than others. It did transpire however, that different-size squares had considerably less successes (13%) than same-size squares (31%). It has already been mentioned that this was due to position being required on different-size items. There were slightly more successes in the horizontal than vertical plane.

Words used to describe spatial relations. It has become evident that the key to success in this task was to be able to describe the topographical relationship of the coloured squares on the white cards. It is therefore of interest to know the types of words used by the subjects to express this relationship, and to what extent they were used appropriately. Table 6-12 shows the terms used by the sample to describe the two basic spatial relationships, vertical and horizontal. The total number of subjects accounting for the 25 instances shown was 7, a little more than half the sample.

TABLE 6-12

Frequency of words used to describe spatial relationships in stimulus material

ORIENTATION OF SQUARES			
VERTICAL		HORIZONTAL	
Up	5	(3) Along	1 1 (1)
Down	3	(2) Going that way (+ point)	3
Not down	1	(1) Beside	1 (1)
Top	5	(4)	5
Bottom	5	(4)	
Not beside	1	(1)	
	—		
	20		
	—		
Private Language			
Hair Spray; Rocket	6	(1)	

(Figures in brackets refer to number of subjects involved)

A disproportionately higher number of instances relating to the vertical plane was reported, even allowing for the fact that more vertically orientated squares were chosen in the ratio 6:4. One reason for this, apparent from the table, is that there are more terms available to young children, and indeed in the English language, for describing objects having a perpendicular relationship. Asso and Wyke (1973) found that when describing spatial relations 5 year olds used 7 'vertical' terms and only 3 'horizontal' terms. Two of the latter were 'left' and 'right' which were not used in this study. The other term was 'beside' which is the only word, as opposed to a combination of words and gestures, used in this experiment to refer to the horizontal plane. The words relating to objects in the vertical plane, 'up', 'down', 'top', 'bottom' were well

represented in Asso and Wyke's experiment and they also found 'under', 'beneath' and 'underneath'. 'Over' was used by 6 year olds but not by the five year olds. Among appropriate words not recorded at all in either study were 'above', 'below', and 'next (to)'. Some discussion of the way the children employed these words and other strategies used will be given in the section on individual performances which follows.

It is not sufficient to use prepositions which define spatial relationships, they must be used accurately. There was only one instance of a child using such terms inappropriately. This was when the words 'top' and 'bottom' were used to refer to the squares in the card LL. There were two occurrences of negative forms, e.g. 'not down', a finding not reported by Asso and Wyke. Neither of these instances were due to denials of a suggestion by the listener. Some children described their cards according to the distribution of colour as a whole and so would refer to white at the sides, in the middle etc. In such cases the spatial terms were not incorrect but they were unhelpful. Both this and the negation phenomenon will be discussed below.

Individual Strategies.

Requirements of a competent speaker. The general requirements of a speaker in this type of task have been described on a number of occasions previously and the purpose here is only to delineate the specific demands of this task. Three critical dimensions are involved:

(1) Size of squares, (ii) orientation of squares, (iii) location of the big in relation to the little square.

Describing the size of the square should be relatively straightforward when they are different since the contrast, which it was argued earlier was necessary to determine size, is present on the cards. In such cases an appreciation of size does not require the speaker to compare the chosen card with the rest of the set. But same size squares do not have a 'built-in' contrast and this might present problems. However, the

fact that some cards do have the contrast may be sufficient to alert the speaker to the size dimension for all the cards. There is an important difference in this respect in comparison with the blocks material since here size is not a property of the whole object - the card - but of parts of the object - the squares. This again might serve to focus attention on size.

After size the most important feature is orientation. The speaker should provide a message that will tell the listener whether the squares lie in the horizontal or vertical plane. In the horizontal plane expressions like 'side by side', 'beside' or 'next to' adequately convey the orientation of the squares, although it does not seem possible to say categorically that these terms exclude a vertical relationship. In the vertical plane the situation is more clear-cut and words like 'above', 'below', 'under', 'beneath' and expressions like 'up and down' and 'on top of' seem to be satisfactory.

When it comes to location, specifying the precise position of one square in relation to another, the choice of word to describe orientation may clearly be relevant. The word 'above' for instance can serve to indicate orientation and location as in 'the big square is above the little square'. The terms 'below', 'beneath', 'under', and 'on top of' also fulfil both functions adequately but 'up and down' is not precise enough. In such a case, an additional message would be required if location was important. The language does not have the same richness for specifying relative position in the horizontal or lateral plane. When referring to wheels on vehicles we talk about near side and off side, and in cricket, on side and off side. The most precise terms are 'left' and 'right' but this requires that we know the perspective of the observer. There is no one term like 'above' which defines plane and position.¹ This was one

1. Note that in the third dimension, depth, there are satisfactory dual function terms: 'behind' and 'in front of' for example.

reason why the task did not ask the children to determine precise location in the horizontal plane.

The key then, to satisfactory performance, having provided details about size, is having suitable labels to describe the orientation and sometimes the actual position of the squares on the card. There may be occasions when the child perceives the differences between cards but is unable to report them because he is unable to describe what he sees accurately in verbal terms. The other possibility is that he may have the labels but apply them inappropriately.

Subjects who report size exclusively. Consideration of the individual performances shows that the sample broadly divides into two, those who use terms to describe the spatial distribution of squares and those who do not. Five of the younger children fall into this latter category. Having described the size of the squares on their chosen card, which they always do, they appear unable to provide any further assistance when the doll asks for it. When pressed, a common response was 'white' referring to the colour of the card. There was no reason to believe these children did not possess the pertinent words in their vocabularies. Anna, for instance, makes it quite plain that she does. When the two sets of cards are laid out at the start of the experiment for the subject to see that they are identical, Anna's subsequent conversation is as follows:

A: Now whose ... which is which (pointing at the row of cards). Is mine at the bottom?

E: That's right, Anna.

A: And Chu-Chu's at the top.

It is also evident that she employs the terms correctly. Why she fails to do so in the task itself is due, presumably, to her not noticing that the critical differences were ones of orientation. Once again this demands a comparison of the chosen card with the rest of the set. If the description is confined to what is seen on the chosen card, then

mention of the number of squares, their size and possibly their colour would appear to be all that is necessary. Some of the children showed mild irritation at being pressed to provide more information when they believed that they had given all they could. For example Clare.

Clare: It's got two squares ... wee squares.

Chu-Chu: Two wee squares, yes?

Cl: And that's all.

C: Oh! Two wee squares. Can you tell me some more about it, Clare?

Cl: No, because there's no more. Just white.

C: Well, I'm still not sure which card it is.

Cl: Well, that's just all that is on it.

Note that when mentioning colour - 'just white' - she seems to be aware that such information is neither necessary nor helpful.

Paul does his utmost to provide the additional information that the doll seems to want and sometimes describes the back of the card, even though it is blank. In a patient and extended exchange during the second selection Paul eventually hits on something which interests the listener.

Paul: At the top, there's another square at the top, at the bottom there's a square at the bottom, at the top there's a square at the top.

C: Oh, there's a square at the top.

P: At the bottom there's a square at the bottom.

Since size had already been mentioned this description is adequate. But Paul does not refer to the spatial distribution in his next selection, possibly because the squares are in a lateral relationship and, in all, he includes spatial terms in only one trial.

A feature of some subjects who were restricted to the size dimension was that when pressed they began to describe the cards in a detailed but largely unproductive manner. Below are examples from Scott and Sally.

Scott: ... it's one big one, one small one. And white in the middle.

C: Yes.

S: And white at the side and white at the top and white at the other side, and at the bottom.

Sally: This one has got a big square and a little square and its ... one has got big sides and the other has got little sides, and the big one has little corners - big corners - and the little one has got tiny corners.

They seem to set out to give the doll a verbal picture of the card mainly in terms of the distribution of colour on the card, that is where the largest patches of blue and especially white are to be found. They are possibly driven to this end by the doll's persistent questioning and it is a tribute to their patience and willingness to help the doll. It can be seen that spatial terms are used, like 'sides', 'middle', 'corner' and also 'top' and 'bottom', but they are not used in a way that is helpful in determining the selected card. These examples do show that children of this age possess spatial terms and that they are able to use them appropriately e.g. when referring to the sides and corners of the card. One can only assume, therefore, either that they miss the critical differences between ~~the~~ cards or see them but do not appreciate their significance.

This difficulty is highlighted in Gregor's performance, who seems at times to have understood what is required but is never quite able to put together an adequate description. In his first selection he is unable to go beyond the size attribute. When pressed he gives the sort of detailed analytic description he has shown in the past which is quite unhelpful to the listener, e.g. 'it's got points to it on each side and then it's got points'. For the second choice his message is as follows:

Gregor: It's the same one except them are little and 'ee um, and they've only got ... one's at the top and one's at the bottom.

He has provided an adequate description for the card $\begin{smallmatrix} L \\ L \end{smallmatrix}$; unfortunately the card he is describing is LL. At face value he seems to be using 'top' and 'bottom' inappropriately, but it is possible that he is not referring to the coloured squares at all or to only parts of the squares. The use of the phrase 'it's the same one' is only helpful if it refers to the type of previously selected card and if the listener understands this convention.

The following extract from the start of trial 3 gives an idea of the decoding problems of the listener.

G: There was little one and a big one and they've all got ... and them are the same. Then (?) the little one's got that (?) on ... one's there sticking out and one at the top and the other one sticking out at the bottom and sticking up a bit and the other ... and it's a big one.

C: There's a big one and a little one.

G: Yes.

C: And one's at the top?

G: Yes ... em.

C: Can you tell me some more about it Gregor?

G: Em ... all right. Well it's little ... And is a big one.

Again he has most of the relevant information but it is not difficult to imagine the problems a child listener would have deciphering the message. He does not appear to have provided the necessary additional detail about the relative positions of the big and little squares.

Some confusion is also evident in his final description.

G: Now, them are both little and them both got sharp points and them are os (?), them are on, but just except ---(?), except one's bigger and one's staller (sic).

Why, having said they are both little, does he say one is bigger? The card in question is $\begin{smallmatrix} \text{L} \\ \text{L} \end{smallmatrix}$. Perhaps he is trying to communicate the orientation of the squares. In this context the word 'staller' may mean taller, though it may easily mean smaller in contrast to bigger used earlier. In any event it again presents a formidable problem for the decoder.

Idiosyncratic strategies. When speakers are aware of the importance of orientation and position, and make an attempt to signify this information, their performance may be marked by idiosyncratic terminology which varies in its communicative effectiveness. Table 6-10 shows that Alan is one of only two children who always reports the plane in which the squares are lying. Unfortunately his first two selections are $\begin{smallmatrix} \text{L} \\ \text{L} \end{smallmatrix}$ and $\begin{smallmatrix} \text{L} \\ \text{L} \end{smallmatrix}$. For $\begin{smallmatrix} \text{L} \\ \text{L} \end{smallmatrix}$ his first two messages are as follows:

- (1) It's got a big square and a wee square.
- (2) And the wee, and the big one is pointing up.

The listener has understood from this that a big and little square are involved and that they are in a vertical orientation. The remainder of a lengthy exchange on this first trial is devoted to trying to obtain the additional information about position. Alan seems to think that the doll has not understood what pointing up means and accompanies statements like '... they're all pointing ... two of them are pointing up' with an index finger raised in a vertical position. Showing remarkable patience in the face of continual questioning from the doll he later says, 'They're not pointing down but they're pointing up'.

It is not surprising that Alan is dismayed at the doll apparently not understanding 'pointing up'. It is evident from the first two trials that the semantics of the situation for Alan is as shown in Figure 6-5. If he had chosen same size squares his terminology would

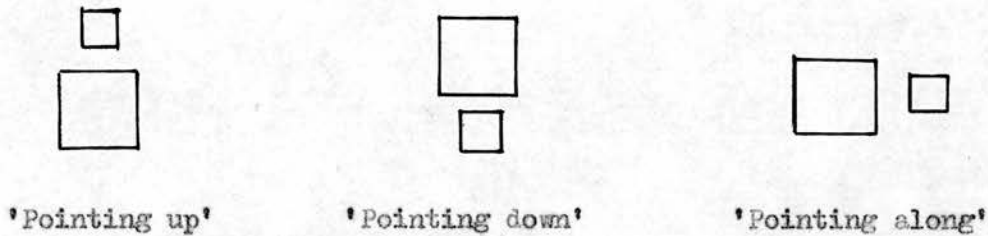


Figure 6-5

have been adequate.¹ But for him those words satisfactorily describe the situation as he sees it, that is 'pointing up' means the little square above the big one. As he himself says, this is 'not (the same as) pointing down'. The way in which he uses these descriptions suggests he sees the pattern which the squares make as a gestalt and it is this which he describes rather than the relationship of the squares to each other. If anything he is describing the squares as a unit in relation to the card. Yet his perception is not entirely holistic since he does report size for two of the cards.

The particular strategy adopted by Alan poses the interesting question of how he would have reacted to material such as that shown in Figure 6-6. Here, although identical objects are used in each picture

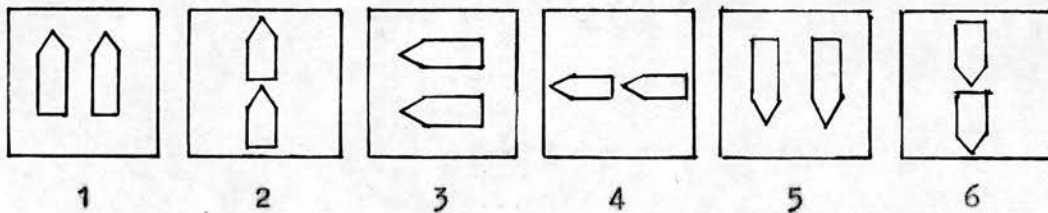


Figure 6-6

their particular alignment means that 'pointing up' could apply to 1 and 2, 'pointing along' to 3 and 4, and 'pointing down' to 5 and 6.

An extract from his final selection reveals another feature of his performance.

Alan: It's only got two now, and it's pointing up.

1. This is not to say that Alan's descriptions are unreasonable since in practice they may well be adequate. Nevertheless they are not a clearly unambiguous specification of the relationship involved.

C: Pointing up, yes.

A: It's not very near ... seems (2)/same (?)

C: Yes, can you tell me some more about it?

A: It's pointing up and it ... it's not beside the other one,
it's a little bit.

C: It's not beside it?

A: No, but a little bit.

This is the second occasion on which he has used the negative form, in this case 'not beside', and at face value it represents a sophisticated understanding of spatial terms. He knows for instance that 'not down' implies the inverse 'up' and 'not beside' implies the vertical plane up/down. It may be said that the particular abstract material used, prevented him from fully demonstrating his appreciation of spatial relationships. It would certainly be worth replicating the experiment with readily codable objects such as animals or household objects. Lee uses a ploy that Alan showed, that of pointing her finger to indicate the plane of the squares. She does this consistently in company with the phrase 'Going that way'. By this strategy she achieves an adequate description on every trial - the only child to do so. She was assisted by not selecting the cards $\frac{B}{L}$ and $\frac{L}{B}$ which would have required information about precise position. When she does choose a card with different size squares, BL, although position is not critical she might be said to transmit it.

Lee: They're going that way (pointing along in the direction of
the door).

C: Which way?

L: That way (indicates with hand towards door.)

C: Oh, they're going that way.

L: The wee one's going that way (pointing with arm outstretched
towards door).

This could be taken to imply that in the chosen card the little square was next to the big square in the horizontal plane with the little square nearest the door, a high level of communicative ability.

When we look at the genesis of Lee's strategy we see a familiar pattern. The child operates at a particular level which to her is entirely appropriate, which inevitably means that she is unlikely to understand that a different approach is required. When a switch does occur it happens quite suddenly when apparently an extra dimension is perceived and reported. In common with the rest of the sample Lee reports the size of the squares and, when asked for more detail, follows up with colour and shape, both redundant features. When the doll says that he is still unable to choose she is puzzled and for a while no progress is made. Then, while looking at her array, it appears that she notices an additional feature - the orientation of the squares - and reports this by saying 'they're going that way' and pointing in a sideways direction. The 'break-through' would seem to be due to the speaker comparing the chosen card with the rest of the set and perceiving an attribute which only assumes force because of this comparison procedure. This is not to say, as has been argued earlier for other attributes, that comparison is necessary to recognise the spatial relationship, but without it such information is unlikely to register.

In the last trial the listener attempts to get Lee to verbalise the orientation which she has been content to describe with a gesture. The dialogue is as follows:

Lee: There's two big ones, square and blue, and going that way (moves finger along horizontal plane in direction of door).

C: Can you tell me about them? Two big ones.

L: (Slightly puzzled) Square and blue.

C: Yes.


- L: Going that way (points towards door)
- C: Can you tell me about them? Two big ones.
- L: (Slightly puzzled) Square and blue.
- C: Yes
- L: Going that way (points towards door)
- C: Can you tell me which way they're going.?
- L: That way (points towards door).
- C: Yes - but can you tell me?
- L: I told yer!
- C: Which way is it?
- L: That way (moves finger in direction of door).
- C: Which way is that, though?
- L: There (points in direction of door).
- C: Can you say it?
- L: (looking down) Eh?
- C: Well - I think I know which one it is BB/BB

This speaker has provided all the necessary information in the opening message. If there had been a large screen between speaker and listener cutting off any possibility of non-verbal communication, that message would not have been adequate. Since the task was designed to investigate verbal communication ability the doll persists in asking Lee if she can tell him which way the squares are going. Somewhat exasperated at being asked to provide information already supplied - 'I told yer' - she is unable to appreciate the subtle difference between verbal and non-verbal communication.

Egocentric speech? Table 6-12 reported the incidence of some imaginative terms to describe the cards, such as 'hair-spray' and 'rocket'. These are used by one subject, Nicholas, and are virtually the only instance of a child projecting private speech onto relatively abstract items.

This is in marked contrast to the findings of Krauss and Glucksberg (1969)

who claim that egocentric descriptions are standard for pre-school children. It has already been pointed out that Krauss and Glucksberg's highly abstract nonsense figures are almost bound to encourage the use of non-social language.

Nicholas's use of such terms represented his attempt to communicate the spatial relationship of the squares. Like Alan, he treats the card as a gestalt while recognising there are differences in the gestalts. As long as the listener also perceives an association between the card  and the description 'hair-spray', then such a description will be adequate. These descriptions (Figure 6-7) represent Nicholas's best endeavours to communicate the differences as he sees them. He is not

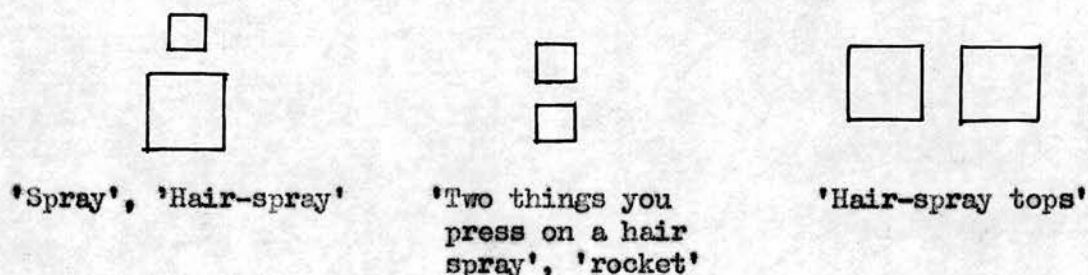


Figure 6-7. Examples of imaginative language used by Nicholas to describe stimulus items.

blind to parts of the whole, however, and does at various times refer to squares and size in addition to using spatial words like 'upwards', 'top' and 'middle'.

Nicholas's terminology would, following Piaget (1926), usually be regarded as egocentric speech and this aspect of child language has too often received uncritical acceptance. The widely accepted view that with egocentric speech "there is no attempt on the part of the child to adapt his speech to the needs of the listener or even to make sure he is listening" (Lovell 1969, p. 75) would seem to be challenged by many of the performances in these studies. The question of whether or not egocentric speech characterises the verbal communication of young children has already received some attention, but the particular case of Nicholas is worth examining. His descriptions would certainly qualify as

egocentric speech as the term is applied by Krauss and Glucksberg, but consider the dialogue in the opening trial:

- N: It's the one with the top; it's like a spray and it has like a cup down at the bottom and like a spraying thing up at the top.
- C: It's like a spade at the top?
- N: Not a spear, a spraying thing like hair spray.
- C: Spray?
- N: Yes.
- C: Oh yes. Can you tell me some more about it, Nicholas?
- N: Yes. Well it's ... er ... it's got round ... a big thing and it's like a cup (making gestures with hands, probably unintentional) and er ... the top one is like a hair spray, down like you press (making pressing down motions with fingers) and the ... it's ... it's like sort of a rocket, but not quite (smiles at E).
- C: Oh, it's like a rocket. I still don't know which one to choose, Nicholas.
- E: I don't think Chu-Chu has seen a hair spray, you see.
- N: It's from two, two, three ... from one, two, three ... um three ... (indicating the number of cards along from end is selected card) One, three.
- E: See if you can tell him about it again, Nicholas.
- C: Yes, can you help me Nicholas?
- N: Well, it's like a spray, a cup - like a cup - (stretching out hands) and it has a round thing and it's like a rocket pointing upwards (points upwards with finger)

Some of Nicholas's terminology is certainly idiosyncratic but there is no evidence here of a speaker making no attempt to adapt his speech to the needs of the listener. Indeed every effort is being made to make the listener understand which card has been selected. Because a word like

'hair-spray' generally has a narrow, well-defined reference its usefulness in this context is limited. But the speaker does not confine himself only to that term for he tries to provide an analytic description of the card, and later introduces a new term, 'rocket'. It seems that the degree of modification and even new descriptions given by very young speakers was underestimated by Krauss and Glucksberg. It may also be true that their task was such that it did not allow any such behaviour.

The danger of a term like egocentric speech, which is usually defined as above by Lovell, is that it oversimplifies and falsely categorises the young child's communicative behaviour. Certain speech, certain behaviour, may look on the surface to be egocentric and therefore by definition can have no communicative function. Closer examination may show that the speech does have a communicative function and that the degree to which it is successful will depend on several factors such as perception of critical differences and possession of an adequate vocabulary. Factors will very often be situation specific and the more general variables involved have been discussed at length in reporting these studies.

It is argued therefore that investigation of the specific cognitive and situational variables involved will tell us more about the development of communication ability than a rather broad classification like egocentric speech. Egocentrism, as discussed by Piaget (1962) for instance, can be seen to be having an influence on performance and the finding that the child as listener tends to impose his choice on the situation, was discussed in the last section. Yet, though it is possible to see traces of egocentrism influencing communication behaviour, it remains questionable whether the molar level at which Piaget explains such functioning provides a sufficient account.

A quite different feature of Nicholas's approach, also illustrated in the above extract, is to report the position of the selected card in

the array. This piece of behaviour may indicate a recognition of the exact one to one correspondence that there is between the cards, since they remain in the positions that they occupied when the initial matching procedure was carried out. If it does, it represents a particularly shrewd strategy. It is not taken up by the doll since such a ploy had been excluded as an illegitimate method of communication in this task. Scott was another subject to adopt this procedure.

Using spatial terms appropriately. The results of the group's performance as a whole ~~we~~ have already shown that success is restricted in this task. We know that success can be effectively measured by the extent to which children are able to use words describing spatial relationships. On an individual level, Linda is the most effective at this. She uses words like 'beside', 'top' and 'bottom' to achieve adequate descriptions in three out of four selections. A peculiar feature of her performance is to compare explicitly the chosen card with another similar card. In trial 1, having established that her choice has two little squares, she goes on to say 'It's like another wee one on a big one'. The listener takes that to mean that the card is $\begin{smallmatrix} L \\ L \end{smallmatrix}$, investing the word 'on' with the connotation 'above'. In fact her choice is LL and it is not clear why she describes the horizontal plane in this way.

In the second trial she uses a similar strategy more successfully.

Linda: There's two big ones with no wee ones on it. It's white, and
nothing on the back.

C: Can you tell me some more about it, Linda? I'm still not sure
which one it is.

L: There's two big ones ... and it's the same as a wee .. as a wee
one beside a big one.

Since she clearly knows when to use the word 'beside', why does she not use it directly to describe her own card? The reason may have something to do with the contrast between different size squares. It may, in this

case, be a matter of relationships being more difficult to express (and perceive) for same-size as opposed to different-size squares. It may even be that different words for the constituents - big and wee - highlight the contrast and also provide 'pegs' on which to hang the comparison. In other words the suggestion is that it may be in some sense easier to say 'big beside little' than 'big beside big'. Such a hypothesis could of course be tested.

For her next selection Linda chooses a card with different-size squares and accordingly, by the above hypothesis, should make the description easier for herself.

L: There's a wee one a big one. And it's got white and blue.

C: Yes. I'm still not sure which one it is. It's a wee one and a big one. Can you tell me some more about it?

L: Yes. It's got a wee one down on the bottom and a big one at the top.

This represents one of the few examples of a perfectly adequate description in this task. In view of this, the difficulty in trial 1 may be the result of an executive error, that is, a slip in the choice of word. Her last selection is such that an adequate description needs only to report size, and so no further data is forthcoming about the description of orientation and location.

Child as Listener

The results and discussion for this condition will include a brief presentation of group data, the ways in which subjects signal recognition of inadequate messages, a break-down and discussion of successful strategies employed and the use and understanding of spatial terms. But first some efficient strategies for listeners are suggested.

In the restricted form in which the experiment was given, the listener always began the task with one piece of information supplied, namely the

size of the squares.¹ The difficulty of the task was automatically determined according to whether the squares were the same size (big ones or wee ones) or a different size (big one and a wee one). Two efficient strategies which might be followed for these respective starting points are set out below.

Situation one.

Initial message:

Big one and little one

First question (re plane):

Up and down?

If YES

If NO

Second question (re position)

Big one at the top?

then BL

If YES

If NO

then B
L

then L
B

Situation two.

Initial message:

Two Big Ones

First question (re plane):

Up and down?

If YES

If NO

then B
B

then BB

The exact form of the questions is largely a matter of individual taste, it only being necessary that they are comprehensible to the partner in the communication task. The important thing is to ask the question

-
1. The reason for doing this was that size was almost always reported when the subjects were speakers, and so to give them another feature, like orientation, would virtually be giving the whole description to the listener. Furthermore the main purpose of this particular task was to see to what extent the children could utilise spatial terms. Nevertheless, if the sample had been larger, it would have been interesting as well as a useful control, to see if size was sought as the second feature by most children, having been given plane.

about plane first since this may then allow a correct choice straight away (always in Situation Two, and if the horizontal plane is established in Situation One).

It should be noted that there might arise situations where the initial message itself was adequate. In Situation Two, for example, if there was only one card remaining with two big squares. In the present experiment this possibility was deliberately avoided, but strictly speaking the first action of the listener should be to scan the array to see how many cards applied to the description given. On this basis the listener could then begin to seek further information from the speaker.

Group Data. 16 of the 44 trials resulted in speaker's and listener's cards matching; which necessarily followed a successful operation by the listener in securing the information needed to determine the speaker's choice. Table 6-15 shows that these successes are not evenly distributed since four subjects accounted for 14 of the matches. Five subjects achieved no correct selections.

As in the earlier blocks study, failure in this task was primarily a function of selecting on the basis of the first message. Performances tended to follow a standard pattern. The doll would say what size the squares were on the chosen card and the listener would pick out a card from the set saying either 'I know which one' (Linda) or 'I think it's that one' (Alan) or even 'Easy-peasy, I know which one it is - that one' (Nicholas). Sometimes a selection was made without any verbal response. In every case, however, the doll would ask 'Do you know which one it is?' and this group of subjects would affirm their choice.

In an attempt to gauge the strength of their conviction, the doll introduced an additional dimension (plane) after they had made their selection on the third trial. The general reaction was to comply with the fresh information and to change their card if it did not correspond with the new input. (Such correct matches have not been included in the

above totals). It did not lead to any change in approach however, nor occasion any real surprise, and these subjects continued their usual strategy in the final trial. It would seem therefore that these children are able to make good use of critical information when it is provided but are unable to secure it for themselves. What is more they do not seem to regard such information as necessary - they are content to select on the basis of the first message.¹ This seems to suggest a fundamental misunderstanding of the purpose of the task. A little light is thrown on this question when the data on the children's judgements of completed selections is discussed below.

Recognising an inadequate message. The key to an adequate performance lay in asking for information about the orientation and possibly exact location of squares. A pre-requisite for the information-seeking role of the listener was the recognition that the initial message was ambiguous. A first sign of this recognition might be uncertainty and an answer of 'No' to the question 'Do you know which one it is?'. Such a reaction is shown by Clare. She recognises a dilemma but is unsure how to resolve it.

Chu-Chu: The first one I've chosen has got a big one and a wee one on it.

Clare: (looks at her array - N R).

C: Do you know which one I've chosen?

Cl: No.

1. Donaldson's description of 'arbitrary errors' seems to fit this behaviour: "... (the subjects) appeared to make decisions that were unjustified both in the sense that there seemed to be no rational basis for deciding, and that the subject offered no support for his conclusion, simply making up his mind: 'It is so'." (Donaldson, 1971, p. 87).

C: Why not?

Cl: Cos I just don't know.

C: It's got a big one and a wee one on it.

Cl: And some white?

C: Yes, there's white on it.

E: If you're not sure Clare, see if you can find out by asking Chu-Chu.

C: There's a big one and a wee one on it - and its white.

Cl: Has it got blue squares?

C: Yes.

Cl: Now I know which one it is.

C: Well, put it in the box then.

There is a suspicion that asking about an irrelevant feature like colour is something of a compensatory action to offset her present inability to discover the appropriate strategy. Having found a way to 'justify' her choice, she uses the same tactic in the following trial. But being an intelligent child the uncertainty remains with her and in the final trial there is an indication that she has begun to recognise the nature of the problem.

C: This one has got a big one and a wee one on it.

Cl: I know which one it is.

C: Well, put it in the box then.

Cl: I've got two of them (having put one in box).

C: Well, this one, the big one's below the wee one.

Cl: Well, I've got it (removing original choice from box).

Well, it's another - it's the other one (picking up $\frac{L}{B}$)

C: The big one's below the wee one.

Cl: Is the big one at the bottom?

C: Yes.

Cl: Well, I've got that one.

$\frac{L}{B}$ $\frac{L}{B}$

She is almost on the point of completing the task when she notices there are two cards which fit the doll's description. Verbalising this perception is enough to earn her more feedback and she goes on to select the correct card.

Successful strategies. The elements of a successful strategy have been outlined already. The key to an adequate performance lay in asking for details about the orientation and possibly specific location of squares. Table 6-13 provides a breakdown of how this was achieved by the capable subjects.

The general question, which seeks information in a broad, unspecific way, is the most economic strategy and as such may be considered the best. It may however be so general as to be of little help to a poor speaker. Those children who did not really grasp the role of the listener would say something like, 'Which one?' when told to ask the doll if they did not know which one he meant. This would not be a helpful rejoinder to a peer in a communication situation like this.

We have already seen that Clare used a response of this general form when she said, 'I've got two of them'. This makes the ambiguity of the original message quite clear and it was a standard feedback in an earlier study when an adult acted as an ideal listener. It was found, however, that most subjects failed to realise the implicit request behind this statement. A more specific demand was usually required. Thus there is reason to doubt the effectiveness of Clare's strategy in a peer group situation.

Lee was quick to see that correct card choice was contingent on information concerning direction. She accordingly confined her response to 'Which way?' This approach was satisfactory for same size squares, but was not strictly adequate where position as well as orientation was required. In practice the doll's planned feedback was not able to take account of this method of requesting information and Lee's

TABLE 6-13

Strategies used by children as Listener to gain more information from

Speaker

TYPE	FORM	EXAMPLES	SUBJECTS
GENERAL	What plane are the squares in? I've got two squares like that	What way? I've got two of them	Lee (4) Clare (1) 5
SPECIFIC (i) UNITARY	A little one at the top and a big one at the bottom? Next to each other?	Is the big one on the top and the wee one on the bottom? Is the wee one at the top and one down the bottom? At the sides? Is it up or down? Point down? Is the big one at the bottom? Are they beside each other?	Scott John Paul Scott Gregor (2) Gregor Clare Christine 9
(ii) DOUBLE	A big one at the top and a little one at the bottom or a little one at the top and a big one at the bottom?	[As in 'Form']	Scott 1
(iii) EXHAUSTIVE	Beside one another or one above the other?	Beside each other or on top of each other?	Christine 1 TOTAL 16

response was sufficient therefore, to secure all the necessary information.

What has been called the Specific question appeared in three forms which varied in their efficiency. The Unitary Specific occurs through the child having made a selection on the basis of the inadequate initial message. Gregor for example, having been told that the card had two wee ones, selected the card with small squares in the vertical plane and

said 'Point down?' In this instance his selection was confirmed and he retained it. In the following trial his enquiry 'Up or down?' was met by the response 'beside each other', and he had to discard his vertical selection in favour of a horizontal one. The limitation of the Unitary Specific question is that because it arises out of focussing attention on one type of card, feedback which does not confirm the original selection may nevertheless see that selection retained. In practice there was only one instance of this happening, but bearing in mind previous results, this is probably not a true reflection of this eventuality. (Cf. p.227)

Table 6-13 shows that the Unitary Specific is the most popular method of obtaining more detail and this is in accord with earlier findings. Typically the subject selects a card on the basis of the first message and his question is by way of confirming his choice. As long as he acts on the reply should it prove negative, such a procedure will be efficient in this task where the amount of additional information required is minimal.

A more efficient procedure is described as the Double Specific question. In this the subject again makes an unwarranted assumption about plane but realises that the squares can be in one of two orders. Thus we get the approach shown by Scott.

C: This one Scott ...

S: Uh huh.

C: ... has got a big one and a wee one on it.

S: Is the big one at the top and the wee one at the bottom, or is the wee one at the top and the big one at the bottom.

C: No. The wee one and the big one are beside each other.

S: The wee one and the big one ...(looking at array) This is it (selecting card).

C: Have you got it?

S: Mmhm.

C: O.K. Put it in the box. BL/BL

His long question is a considerable feat in memory and semantic organisation, but he does not consider the other possibility that the squares may not be in the vertical plane at all. In reality only two cards $\begin{smallmatrix} B \\ L \end{smallmatrix}$ and BL fitted the initial description since $\begin{smallmatrix} L \\ B \end{smallmatrix}$ had been selected on an earlier trial. His question as phrased was therefore redundant. His reason for posing it probably stems from the first trial when he asked a specific question - 'Is the big one on the top and the wee one at the bottom?' The doll's reply was 'No, the wee one's at the top and the big one's on the bottom.' When the occasion next presents itself he is able to include these alternatives in one question. He is demonstrating a technique acquired but he is not directly relating it to the context at hand. The important thing is that when the feedback requires him to turn his attention to another card, BL, he is able to do so.

The most efficient strategy used is one that exhausts all the possibilities in an explicit way, referred to as the Specific Exhaustive. Christine was the only child to adopt it.

Chu-Chu: Two wee ones on it.

Christine: Beside each other or on top of each other?

C-C: Beside each other.

C: (Puts her choice in box).

C-C: Have you got it?

C: Mm humm.

It was noticeable that her approach was based on a consideration of the set as a whole and that she did not make a selection until she had received an adequate message.

How do these observed strategies relate to those hypothesised earlier? (p.270). Subjects generally tend to enquire about the plane of the squares. This varied from Lee's 'What way?' to Christine's highly

competent exhaustive question. Between these the other questions correspond to those given in the hypothesised examples, e.g. 'up and down', and called Unitary Specific in the analysis presented. Other subjects (Scott, Clare and Paul) ask about position initially. When position is not relevant, as it is not for five of the cards, Situation Two is in force and a question about position serves the same purpose as a question about plane, for example Scott's 'Is one wee one at the top and one down the bottom?' following the initial message: 'Two wee ones'. When Situation One obtains, the initial message is 'a big one and a wee one'. A question about position can serve to short-cut the procedure, but the example of Scott above shows that such a strategy makes an unwarranted assumption that plane is known. Such a course does not adversely affect performance in this task, but might well do so if the set of alternatives were greater.

Comprehension and use of spatial terms. Table 6-14 gives the words used to seek information about the spatial relationship of the squares. Words relating to the vertical plane are again in a majority. It is significant that positional terms like 'top' and 'bottom' are most in evidence when cards with different size squares are selected. There was no appearance of idiosyncratic terms like 'hair-spray' in this condition.

The doll confined its spatial vocabulary to words used by the children when they acted as speakers. There was nevertheless one notable lack of comprehension by Lee.

- C: This one's got two big ones on it.
 L: What way?
 C: The two big ones are beside each other.
 L: But what way are they going?
 C: They're going across the way.
 L: (Selects card and puts it in the box).

The Scottish manner of describing the lateral plane - across the

TABLE 6-14

Spatial terms used by children as Listeners.

INITIAL MESSAGE				TOTAL
	Two Big Ones	Two Wee Ones	A Big & Wee One	
On top of	1	1	0	2
Up/Down	1	1	1	3
Top/Bottom	0	1	4	5
Beside	1	1	1	3
Sides	2	0	0	2

TABLE 6-15

Comparison of performances of children as Speakers and Listeners in
Cards Task

SUBJECT	STRATEGIES LEADING TO CORRECT SELECTION	
	SPEAKER (adequate descriptions)	LISTENER
Alan	0	0
Lee	4	4
Linda	2*	0
Scott	1	4
Gregor	0	3
Sally	0	0
Elizabeth	0	0
Nicholas	1*	0
Clare	0	1
Paul	1*	1
Christine	0	3
	9	16

* These subjects obtained one additional adequate description each, but since these were achieved by reporting only one attribute they are not included in this comparison data. One subject, Anna, took part in only one condition and is therefore excluded.

way - was more meaningful to Lee than 'beside'. This is not to say she does not understand the word 'beside', but rather that she had what amounted to a set or predisposition for interpreting orientation using the word 'way'.

Comparison of Performances as Speaker and Listener

Table 6-15 shows that the children perform better as listeners (16) than speakers (9). As a percentage of the total this is a 20% success rate for speakers, as compared with 36% for listeners. Thus in both situations the level of success is small, but considerably better in the listening condition where more than one-third of the trials are concluded successfully.

Table 6-15 also shows that only one subject (Lee) is consistently good at both roles, otherwise there appears to be no correlation except possibly an inverse one. Three children who show no ability as speakers perform very creditably as listeners, (Scott, Grigor, Christine). One good speaker (Linda) has no success as a listener. This suggests that the greater success in the listener condition is not a simple practice effect. A more plausible reason is that some reference to spatial relations is sufficient to obtain an adequate description from the doll whereas speakers, when children, had often to give plane and location as well as size if the message was to be adequate. It is not easy to explain the comparative failure of a subject who was successful in the speaker condition, like Linda. The answer may lie in the fact that the speaker role requires the child to be active, to talk about the chosen card. Linda achieves success by talking about her pictures. In the listener condition the role is perhaps seen as one of choosing pictures and not talking about them. The passive nature of the listener's role has been emphasised in the past as a limiting factor in young children's communication. It was hoped that the doll would compensate for this by encouraging children to talk through helping the doll, and in terms of

degree of interaction between listener and doll, this aim could be said to have succeeded. Despite this a number of the children still seemed to have difficulty in appreciating that there was an active role to play as listener.

Comparison of Selections

How far is inefficient performance due to a failure to perceive the differences between cards? To throw some light upon this question subjects were given an opportunity to judge the choices at the end of the session. The experimenter would always ask, 'Is this one the same as this one?', and point at the relevant cards. The results of these comparisons, for both conditions, are summarised in Table 6-16

TABLE 6-16

Children's ability to identify differences in chosen cards which do not match: (summed data)

CARDS	<u>S</u> as SPEAKER	<u>S</u> as LISTENER
MATCHING SELECTIONS	14	23
MISMATCH IDENTIFIED with correct justification	22	15
MISMATCH NOT IDENTIFIED	8	6

The important figures above are those concerning mismatch situations, since the match figures, apart from not being strictly relevant to the question of perception of difference, are not always a function of adequate descriptions, i.e. they may occur fortuitously following a partially adequate description.

It can be seen that the majority of mismatches are perceived by the children and correct justifications offered for them. The 'misses' are confined to a few subjects (notably Clare, Nicholas and Paul) who,

rather than failing to see the differences, are probably operating on a different criterion of same.¹ Thus $\frac{B}{L}$ and $\frac{L}{B}$ are the same because they both have a big and a little square.

Apart from the success rate already discussed, there are minimal differences between the two conditions - speaker and listener - as far as the proportion of mismatches identified is concerned.

Note on research into the development of spatial terms.

Asso and Wyke (1970, 1973) used a formal task situation to investigate young children's comprehension of spatial terms. The material consisted of line drawings such as those shown in Figure 6-8. The standard instruction was in the form: 'Show me the card in which the ball is over the line.'

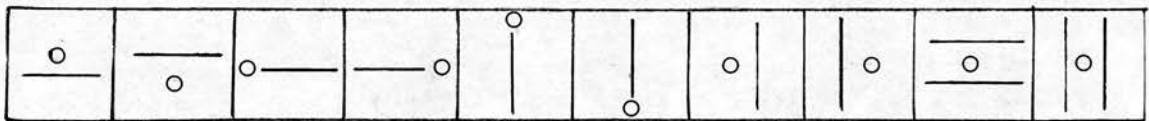


Figure 6-8

The other spatial words used were under, beside, between, left, right, and centre. These were chosen on the basis of their frequency in the Thorndike - Lorge word count. The results of Asso and Wyke's 1973 study, when the children were asked to describe the spatial relationship portrayed in the drawings, revealed that over and under were used very little by five year olds - in the case of over, not at all. Top and bottom are much more popular ways of describing the vertical orientation. It is unlikely therefore that the figure of less than 40% correct responses for five year olds in the comprehension task is misleading.

1. Despite the earlier research into this topic (Chapter 5, Study I) it appears there may still be a failure to communicate a request to compare identities. If not, then it indicates that perception of differences is a problem for some subjects in this task.

Misleading in the sense that it may not be an accurate reflection of the number of children who understand in verbal terms the relationship between the components in the line drawings illustrated. If the question had been 'Show me the card where the ball is at the top and the line at the bottom' the number of correct responses would undoubtedly have been higher. What Asso and Wyke have shown is that some spatial words are less well understood, by children, than others.

Another issue is the choice of material, and the particular way in which it is described. The fact that the word 'ball' is used, introduces a realism to the pictures which they might not otherwise have, since they are essentially abstract pictures. The observer may, for instance, see the line as a wall, a stick (or even stick figure), or a line as represented in a ball game such as football. In such situations it would not be implausible to use the word beside to describe the position of the ball. If the child pointed to pictures 1 or 2 in response to 'Show me the card in which the ball is beside the line', his response would be judged wrong by Asso and Wyke. Part of the problem is that the picture is treated as having two dimensions, but very often we see a third dimension when we are looking at pictorial representations. A diagram of a tennis court may require the illustration of a serve being out of court. In such an instance picture 2 would be described as the ball over the line, but in the more conventional sense we would say that this represented a circle under a line. Conventional, however, only in the pictorial sense, since in real life these may not be the appropriate spatial terms.

With children these problems are multiplied because it is not easy to explain the assumptions being used. Besides this, children often take meaning from situations which an adult may not do. The impression gained from Asso and Wyke's work is that they have imposed certain categories of meaning for spatial words on their chosen situations and

only later sought to discover the way in which the children themselves might describe these relationships. It is of interest to know that a child does not understand the adult meaning of a word in a particular context, but it is fallacious to assume subsequently that this area of linguistic expression is therefore a blank for the child. The advantage of the communication situation is that the child is free to describe a situation in terms which are meaningful for him. In their 1973 paper, Asso and Wyke say:

"... The younger children used words which were more closely associated in meaning with the concept of direction (e.g. straight on, at the end) position (e.g. in, out, outside) or else described more appropriately a three dimensional spatial relation (e.g. up, underneath). On no occasion could any verbalisation be categorized as being totally unrelated to the concept of space."

Asso and Wyke fail to bring out strongly enough that young children do not describe spatial relationships in the same way as adults, largely because they do not interpret the contexts in the same way. Issues like two-dimensionality, direction and so on do not concern them. What we need to know, however, is whether the children do have verbal terms which do make such contexts meaningful. As argued above, Asso and Wyke talk of correct responses only in relation to their own standards of correctness.

Since we need information about as many different contexts as possible, the Russian approach to this area is of interest. As reported in the introduction, Zinchenko and Kontseva used naturalistic situations in giving the children commands containing spatial words, such as 'Put the checker-piece under the table'. Though no figures were reported, they claimed that children of three-four years of age understood the relation over and under, "quite well". The author has carried out a small study looking at the effect of context on the interpretation of commands. Three of these commands included spatial terms. They required the child to put one object on, underneath and by another object, respectively. Fourteen subjects aged between 38 and 58 months took part and only one child had

any difficulty with the word on. Only four subjects interpreted underneath in a literal fashion - the instruction being to put the box underneath the mirror. These subjects picked up the box and placed it under the mirror; another four children put the box on top of the mirror so achieving the same end-point. The most popular response (6) was to put the mirror on top of the box. The word by was contained in a total instruction: 'Close the box and put it by the mirror'. The box was an open matchbox. Leaving aside the first half of the instruction which most of the children handled capably, five children subsequently put the box by, that is adjacent to, the mirror. Six children put the box on the mirror, and one put the mirror on the box. Two subjects did not respond to the second half of the instruction.

It is not, of course, possible to make very much of this restricted set of data, but it does not support the reported Russian findings on 'under'. The context may be crucial, however. Putting something under the table is a more familiar and possibly more natural action than placing one small object beneath another. There is also the issue of reversible sentences (Turner and Rommetveit 1967). Either mirror or box may be the subject of the action, but it is hardly feasible to put a table under a checker-piece. The significant thing that appeared to come from these findings was that objects have certain properties which will affect not only a child's perception but also the way he acts towards them. Putting a matchbox on a small hand mirror is all right, but putting a mirror underneath the box seems to create problems. There may be many reasons for this and Clark (1969) and Huttenlocher (1968) have debated some aspects of the issue at length. The important point to make is that because a child can put a matchbox on a mirror but not by a mirror is not grounds for saying simply that he comprehends on but not by. If, in a different context, he had been asked to put a chair on a table and a chair by a table, the response pattern may well have been

reversed. Some things seem to 'demand' that other things are placed on them, other objects may have a beside relationship with each other.

A recent study germane to this discussion is one by E. Clark (1973). Working with children between 18 months and five years, she has found that what she calls non-linguistic strategies affect their understanding of language, specifically the locatives in, on and under. The non-linguistic strategies amount to a sort of response bias, a preference for behaving towards certain objects in a certain way. It may be that putting a box on, rather than by, a mirror is an example of such a strategy, but it is better to confine remarks to the ones that Clark has demonstrated. Her youngest subjects, average age 21 months, appeared to use two non-linguistic rules when processing sentences like 'Put x in/on/under y'. These were:

Rule 1: If y is a container, then x always goes in it.

Rule 2: If y has a supporting surface, then x always goes on it.

Thus, when presented with y's that were containers, in was handled apparently competently, but on and under were treated as though they meant the same as in. With y's that had supporting surfaces, but were not containers, on was handled in the usual adult sense, but under was treated as on. Particularly fascinating was the finding that in a copying task, using no verbal instructions, where the same subjects were required simply to do the same as the experimenter, they behaved according to the above rules. For example when the experimenter put a toy animal beside a glass container, the child would put it inside the glass.

At a later stage, between two and three years, Clark found the children in a transitional period when they would operate according to a combination of competent linguistic knowledge and non-linguistic strategies of the type discussed. Full semantic knowledge appeared to be attained during the third year, at least for these task situations.

Since a significant amount of research is starting to show that situations can have quite specific effects on language comprehension (e.g. Donaldson and various collaborators, 1968, 1974) a brief word might be said in conclusion about methodology. There is undoubtedly an advantage in a technique which seeks to gain an understanding of children's language in natural contexts. But, since there is probably no such thing as a 'representative' context, they should be varied as much as possible. It is also important that opportunities are available to study production as well as comprehension. In order to understand how much children know about a particular concept it is more valuable to find out how children talk about that conceptual area, if language is of interest, than rely on such data as word counts or even correct responses to instructions interpreted only in terms of adult semantics. In this context Clark's study is an admirable example of how to derive child-centred strategies.

The study reported by Asso and Wyke contained a Description or Speaker stage and a Comprehension or Listener aspect, but was limited by these roles being very much more artificially imposed and confined than need be the case.

The particular advantage of the communication task with the talking doll is that one can observe production and communication taking place in a controlled but relatively natural situation.

Chapter 7. Use of the communication procedure in an ordering task
(seriation).

An original aim of this series of studies was to use the communication situation to investigate more traditional aspects of cognitive development. A task which seemed to lend itself to this approach was seriation - constructing a series of objects in ascending or descending order of size, weight, brightness or some such dimension.

Most of the work in this field has been done, or been inspired, by Piaget. He has been interested in seriation not only for what it reveals about the child's understanding of number but also, and primarily, for what it tells him about operational thinking. Seriation in its mature form has strong affinities with logico-mathematical structures and such structures play a central role in Piaget's theory of intellectual development. The seriation under investigation in these studies is a long way removed from the ultimate operational concept, but since it is regarded by Piaget along with classification and conservation as one of the elementary operational groupings, it would seem to represent a good choice for study.

The Genevan school has always taken care to observe the growth of such behaviour from its earliest appearance and it is appropriate to outline, very briefly, the ordering capacities of children in the pre-operational stage. Piaget and Inhelder (1964) remark on the early appearance of seriation type behaviour:

"Seriation exists at the sensorimotor level even if the relevant behaviour is unsystematic. A necessary condition appears to be that the difference between the elements of the series must be fairly sizeable so that the child can pick them out just by looking at the material."

An example of this would be building up a tower of blocks, or, nesting boxes. On the basis of evidence we need not go into here, Piaget has determined that the perceptual configuration which aids seriation is itself a function of the subjects previous actions. He has also

satisfied himself that such perceptual information can give rise to what he calls semi-anticipation of seriation around 5 - 6 years, but this must not be confused with operational seriation. The former is usually achieved on a trial and error basis and can be upset when the series does not make a recognised 'good' form.

Oxilia and Schircks (reported in Piaget and Inhelder, 1964) found that in a sample of four year olds 53% made no attempt at seriation while the remaining 47% achieved small unco-ordinated series. This usually involves putting 2, 3 or 4 elements into sub-series but without being able to assemble a co-ordinated seriation. Of the five year olds 12% were successful using a trial and error method, while 9% seriated with an operational method. In brief we can say that the child of pre-school age being used in this sample would not be expected to have reached an operational level of seriation.

Apart from the main aim of observing communication behaviour in an established area of cognitive developmental research, the importance of the study was seen to be methodological. An approach which requires children to describe behaviour which is assumed to reflect underlying cognitive processes could presumably be of value. Sinclair (see below) has used a procedure which asked children to say what they were doing in an ordering task, but no study appears to have employed the communication situation as investigated in these studies, which is essentially a verbal interaction between two people engaged on the same enterprise.

In terms of the details of the task, it seemed sensible to have the children work first with material which by its perceptual form would encourage seriation behaviour, such as a tower of bricks. If this proved successful then the more traditional items used by Piaget and Szeminska (1952), sticks increasing uniformly in height, should be tried.

It was thought that a major difficulty in this task would be that of giving names to the objects to be seriated. Obviously without names for the various elements there could be no communication at all. A study by Sinclair, reported in Inhelder (1968), had asked children to describe a seriation problem; she found that they used words like long and short and at a later stage qualified them in the form: tiny, very short, a bit short, middling long, long etc. It seemed unreasonable to expect pre-school children to be able to handle such comparative terms with any degree of competence. Accordingly in the current experiment, pictures of well-known objects were painted on the items to be ordered, thus giving them clear labels. The children would then be able to describe their behaviour in terms like 'Put the (stick which has the) cat next to the house, and the flower next to the cat' and so on, where cat, house and flower might be sticks of varying heights. While this would greatly reduce the difficulties of encoding and decoding, it would not lessen the demands of the seriation task itself.

To insure that communication to some purpose took place, one member of each pair had a preliminary session with the materials during which the seriation task was presented. It was intended that each child should show a certain competence in the task before being asked to instruct a peer. Once in the communication situation they would tell a naive subject how to order the elements and, in turn, the naive subject would take the role of the speaker to see how efficiently he could instruct the experienced subject.

Communicating Seriation - Experiment One.

Method

Subjects

Ten children, 4 boys, 6 girls with an age range 5 years 2 months to 3 years 11 months. Mean age 4 years 6 months. The sample were split

into five groups of two to provide the communication pairs.

Materials

Two identical sets of six square blocks, with a uniform thickness of 1.8cm but increasing in length and breadth by equivalent amounts of 2cm from the smallest, 3.4cm, up to 13.4cm. Each block had a centrally drilled hole of 1.2cm for stacking on a peg set vertically in a wooden base. Each block had a familiar object painted on it, each picture taking up an equivalent proportion (about 10%) of the block. In order of ascendance the pictures were: ball, flower, car, telephone, key, dog. Two small screens, 16cm high, 60cm wide.

Procedure

Before the experiment all the subjects were individually shown the pictures to be used on the blocks to ensure they could identify them.

Preliminary session: In a preliminary session one member of each of the five pairs was presented with the material to be used to familiarise them with the seriation task. The blocks were presented stacked on the stick in descending order of size with the biggest at the bottom and the smallest at the top. The instructions were as follows:

1. 'Look what I have here, There are some blocks on a stick. A big one at the bottom and a wee one on the top, and these other ones going up (pointing finger), do you see? It makes a sort of castle, doesn't it? Now let's take them all off the stick. Do you see that they have pictures on them? What's that one? (E scrambles blocks on table and asks child to identify the pictures on each one.) Now see if you can make a castle just like the one I showed you, putting the blocks on the stick'

The order of seriation was noted. If incorrect the experimenter continued:

2. 'Is that just like the one I did? Does it start with the big one at the bottom and go right up to the wee one? Which one should we have at the bottom? Which is the biggest one? What picture

has it got on it? Now see if you can make a castle like I did.'

If the child is still unsuccessful, E continues:

3. 'Let's start again shall we? Which block goes on first? It's the biggest one, isn't it? And which goes on at the end? On the very top? Yes, the wee-est one. So the rest must go in the middle, mustn't they? Now put on the block that goes at the bottom. Now, which is the next biggest one? Right, put that on. Now see if you can make a castle like the one you saw.'
4. If the child is still unable to reproduce the seriated set of blocks, an identical model is introduced.

'Look, here's the castle I made. Can you make one like that? (The model is left until the child has achieved seriation)

The preliminary session was concluded when one errorless seriation, large to small, had been achieved.

Communication Task: In the communication session, the member of the pair who had already had some experience of seriation with the materials (the experienced subject - ES) was taken into the experimental room first and told that they were going to play the same game as before but this time he must tell a friend of his how to do it. As a reminder the blocks in the finished position were briefly shown to the child, and then taken off and scrambled on the table. The naive subject (NS) was then fetched and the following instructions were given.

'We are going to play with these blocks and this stick today. (The blocks are lying in random order on the table). ES has seen them before. We had a game with them before, and ES will tell you what to do. Can you see the pictures on them? Tell me what they are (the experimenter ascertains that NS knows the names. As NS identifies the blocks, E points out the same blocks in the other child's array). Small screens were then put in front of each child's materials so that they were not visible to the other subject.

(To NS) Now you've both got the same blocks, haven't you? Now will you listen carefully to ES because he is going to tell you how to put your blocks on the stick.

(To ES) Now will you tell NS what to do. Make the same thing you made before for me, so that you both have the same blocks on the stick.

At the completion of a trial, usually when all blocks were on the peg but also if subjects indicated they had finished, the screens were removed so that a comparison of seriations could be made. The experimenter asked if the series were just the same and, if they were not, for the subjects to indicate the differences. The experienced subject invariably supplied this information.

When the experienced child had successfully transmitted instructions about seriating in the order learned, the new subject took a turn as speaker and instructed the experienced subject. After this the experienced subject again assumed the role of speaker and was this time asked to build up the blocks in the reverse order, from little to big. If this was achieved successfully the naive subject attempted the same task. A summary of the experimental design is given in Table 7-1. All sessions were videotaped.

TABLE 7-1 Experimental design of Experiment One in Seriation.

PART ONE		PART TWO	
ORDER LEARNED (BIG - LITTLE)		REVERSE ORDER (LITTLE - BIG)	
TRIAL 1 Speaker Listener ES ES NS	TRIAL 2 Speaker Listener NS ES	TRIAL 3 Speaker Listener ES NS	TRIAL 4 Speaker Listener NS ES

Results and Discussion

The communication experiments involving seriation are preliminary investigations with two main purposes:-

1. How does the communication situation operate when a comparatively sophisticated intellectual concept is required?
2. What does the communication procedure reveal about the nature of this concept?

The results are affected because each condition in Table 7-1 was not completed by all subjects. This was due to limitations of time or subject ability. Since the sample was in any case small this necessarily means the findings can only be presented in the form of fairly broad inferences. These are based on an analysis of the complete behavioural record from videotape.

The first point to note is the general competence of the subjects. This was first apparent in the preliminary session when one member of each pair was given the opportunity to 'practice' the seriation task. Three out of the five carried out the operation successfully first time, and another subject achieved this on her second trial. Only one subject had serious difficulty, but she worked her way through by trial and error to a correct solution on her fourth attempt.

Table 7-2 summarises performances in the communication session. The most noticeable statistic is that 15 seriations are completed in a total of 21 trials, that is 6 of the trials contain error. But, since some of these mistakes are corrected spontaneously by the speaker, a more realistic figure is 4 incorrect trials, a failure rate of only 19%. These figures are based only on the speakers' performances, in other words the verbal report. But because both subjects play both roles, the experienced and naive subjects are represented. It is only experienced subjects, in fact, who make errors, but this is partly due

to their playing a bigger part in the process.

TABLE 7-2 Number of successful and unsuccessful seriations by
speakers in communication situation.

SPEAKER	ORDER LEARNED BIG → LITTLE		REVERSE ORDER LITTLE → BIG		TOTAL
	Correct	Incorrect	Correct	Incorrect	
Experienced subject	5	4	4	2	15
Naive subject	4	0	2	0	6
TOTAL	9	4	6	2	21

So, it can be said that when they act as speakers, naive subjects perform creditably. Their rate of success is remarkable considering it is based on one exposure to the correct solution by way of verbal instructions from a peer. They have first created the correct assembly in response to their partner's description, and are subsequently able to reproduce this seriation accurately when asked to begin again with the blocks scrambled. It seems unlikely that this is a feat of memory. Some sort of cognitive rule must be hypothesised, though whether based on imagery, language, or some other symbolic form is not clear.

In order to assess the strength of the ordering concept, subjects were asked to seriate in the reverse order, that is construct the series from little to big. This was a task for which none of the subjects had any direct experience to call upon (at least in this experimental situation). Therefore a correct performance could not be the result of simple transfer or generalisation of earlier learning. It would rather suggest a real understanding of the principle of serial order if only in this limited context.

In the event, subjects again performed very capably, there being no significant difference in terms of error rate. An examination of the performances showed that there was initially some hesitation but that once the seriation was underway it proceeded without difficulty. The Speaker-Listener relationship in this task.

It has been pointed out that the speakers perform much better than might be predicted from previous knowledge of seriation in four-year olds. But do the listeners do what the speakers tell them? From the evidence of this study it appears they do. Certainly the naive listener usually follows the experienced speaker faithfully. There are fewer trials of naive subject as speaker and, with very few errors being made, the experienced listener's faith in his less experienced partner is not put to the test. In those instances, however, where the naive speaker is incorrect or uncertain, the experienced listener provides the correct response.

At this point it is worth taking a closer look at the communication set up both in terms of speaker/listener and naive/experienced subject. Do these dichotomies conform to a leader - follower relationship? It is obvious that in the first trial the naive subject is completely dependent on his partner with prior knowledge. However, observers of small children know that the four year old is no respecter of reputations, especially if that reputation belongs to another four-year-old. So it is perhaps worth noting that all the naive subjects were content to follow the example set by their experienced partner. The presence of the adult experimenter may have contributed to this.

Conflict may be expected to occur when the naive/experienced and speaker/listener dimensions work against each other. The experienced subject assumes the role of nominal leader by virtue of his superior knowledge. This is enhanced by his position as the first speaker, since in the communication set-up, the speaker inevitably leads the dialogue.

When the experienced child takes the secondary role of listener there is a potential conflict between his conception of himself as the knowledgeable subject (and therefore leader) and that of the rather passive listening role. This conflict does emerge quite strongly in two of the pairs, but in different ways.

When acting as listener in a male-male group, the experienced subject had difficulty in restraining himself and vocalises far more than the naive subject as listener. At first he aids the speaker when he is uncertain, but eventually assumes the role of speaker himself and by the end of the trial the naive subject is once more an acquiescent follower. When the same pair are seriating in the reverse order, little to big, and the experienced subject is again listener, he is asked for help by the naive speaker. The incident goes as follows:

<p>OBJECTS: Big \longleftrightarrow Little</p> <p> dog - key - telephone - car - flower - ball</p>
--

Naive Speaker (NS): The ball first (puts it on stick)

Experienced Listener (EL): Ball first (puts it on stick)

NS: (looking round his array): Then flower I think, (picking it up)
is it? (looks across at EL).

EL: Er no er you can do it the wrong way round.

The experienced subject's tone of voice and hesitation suggest that, having been asked for his opinion, as the 'understood' leader of the operation he should at this point take over. His 'no' to the naive subject is almost a reflex action. He is then thrown into some difficulty because he realises the naive subject is correct after all. He stalls for a moment and then says, in an important-sounding voice - "you can do it the wrong way round". The experimenter reaffirms that they are going from small to large and then the experienced child announces, as though his partner has not mentioned it - "I think the flower". The way now became open for the experienced subject to assume the speaker role again,

and this he does for the remainder of the trial.

Undoubtedly personality characteristics also contribute to this interaction process and certainly played their part in this instance. The experienced subject in the example above was generally seen to be a more dominating figure in the nursery than his naive colleague.

(Manning, personal communication).

In the other pair where dominance relationships emerged, the conflict appeared as fairly marked competitive behaviour. The dyad was made up of two girls of above average intelligence. They performed the task very competently, and completed the seriation in the 'learned' order in a matter of seconds. For the reverse order, the experimenter did not explicitly determine the roles of speaker and listener and it was the naive subject who looked to the experienced player for a lead. But once the seriation was under way they both vied with one another to be first to announce the correct block. The trial contained some active exchange and co-operation in a competitive way. This somewhat paradoxical statement is explained by the fact that they both wanted to contribute to the task, and in this way it was a co-operative venture. But the co-operation was achieved because one wanted to have as much (if not more) to say as the other. There was a slightly challenging note in their messages.

This co-operation brought about by competition suggests that, in this context, co-operation is more apparent than real. It appears to be present because a statement from one child brings about a change in the behaviour of the other. The competition represents a challenge for the leadership of the dyad and, as such, control of the group. When two subjects are equally proficient at the task, then the urge to outshine one another may be strong. It could be that achievement motivation was already present in these children owing to their circumstances and background.

The dynamics of the communication situation

The experiment provided some information about the young child's speech and thought processes during cognitive activity. It was noticeable that children did not usually communicate information until they were satisfied as to its correctness. In this task when the speaker was uncertain about the block he had selected, he would first assess the choice, check it against what had gone and what remained in the pool, and if he decided to discard it, there would be no mention of it. Only the blocks that actually went on the stick were spoken about. This demonstrates a high degree of speech inhibition and, of course, greatly increases the communication effectiveness. It may be that a task such as this, which is stretching four-year-olds mentally, would as a consequence tend to eliminate unnecessary speech, because the 'channel' is already fully occupied.

This speech inhibition was also seen in error correcting situations with rather less beneficial results. When a subject put a block (or blocks) in the wrong order, and subsequently noticed it, he would either decide to remedy the fault immediately, or remark on it but nevertheless continue to the end giving an incorrect solution. It is the error correcting behaviour which is relevant at this point. What happens is that the speaker communicates what is a wrong block choice as it is put on the stick, then notices the error. At this point he will remedy the situation, often saying 'Oh' or 'No' and effect a change - frequently a transposition - but will not inform the listener of the change. It is as if the extra concentration demanded to correct a fault precludes the ability to comment on the behaviour. Such behaviour is, of course, detrimental to the success of the communication operation. An example will illustrate the point.

The following extract gives the verbal record only, which largely represents the information available to the listener:-

Speaker	<u>Telephone</u>
Listener	<u>Telephone</u>
Speaker	No. <u>Car</u>
Listener	<u>Car?</u>

When this is amplified by the rest of the behavioural record, the nature of the confusion becomes apparent.

Speaker	<u>Telephone</u> (puts it on the stick)
Listener	<u>Telephone</u> (puts it on the stick)
Speaker	(Picks up <u>flower</u> , puts it on top of the stick briefly, but quickly sees it is the wrong choice) No. (Picks up the <u>car</u> and puts it on) <u>Car</u> .
Listener	Car? (Takes off <u>telephone</u> and picks up <u>car</u>).

Here we have examples of the two types of speech inhibition, one adaptive, the other mal-adaptive. The listener not surprisingly connects the speaker's 'No' with the previous instruction, 'telephone', and accordingly makes an adjustment on his stick. Confusion would also have arisen if the speaker had said 'flower' when he handled that block, and the suppression of verbal comment about this is a positive aid to communication efficiency.

The picture is not quite as simple as this, however. Cutting across this analysis are the influences of other variables particularly the experienced/naive dichotomy and the part played by non-verbal factors. Although it was stated that the verbal record is the main source of information to the participants, there are important additional aids. The speaker, for example, comes to expect the small cues which tell him that the listener has responded to his message. This is often a repetition of the message - a sort of acknowledgement - or merely the sound of the block going on the stick which many speakers wait for. Although they

cannot see the block being put on the stick, they can tell by the listener's actions whether or not he is putting a block on the stick, and this is another cue they quickly come to use.

Then, also, the material itself provides clues. The experienced participant, particularly, can utilise these to good effect on occasions, as the following example illustrates. The speaker is the naive subject and makes an error on the third block putting car before telephone. The listener does not remark on this, and puts them in the same order. Even while he is carrying out this action, however, the speaker seems to realise the order is wrong. The verbal record for these few minutes is as follows:

Speaker: And er the car. And er the telephone. No.

That amounts to the sum total of verbal communication between the two, but it does not indicate the considerable amount of non-verbal activity, which itself is reasonably effective as communication.

After saying 'No', the speaker removes the telephone and the car from his stick and puts them back in reverse order, thus serialising correctly. The listener cannot see what is happening, of course, but she hears the word 'No' and then perceives sounds and actions suggesting blocks are being removed from the stick. She has the evidence of her own materials that something might be wrong, and being the experienced subject might very well conclude that to be the case. In any event, she also removes the offending blocks and correctly reverses the order. Hence these young children are performing considerably in excess of the level that might be predicted from the verbal behaviour record.

Listeners are not always experienced, however, and the general pattern is that they take a passive role. This conforms to the findings of earlier experiments with an 'ideal' speaker and with the talking doll. The listener tends to act on the data given by the speaker as though it were sufficient to allow him to make a decision. In the present study

a one-word message is sufficient to allow a choice to be made. Its efficiency is dependent on the speaker's understanding of ordering blocks according to size.

Evidence against the egocentric hypothesis

This study does suggest that speakers, especially experienced ones, do have some consideration for the listener. In this sense, awareness of the two-way interaction of the communication situation is present.

Consider the following example:-

Speaker: I think the flower next (puts it on stick). This is another castle (grins at E).

Listener: (Picks up flower but has trouble putting it on the stick).

S: The motor car.

E: Wait a minute, Alan (L) is getting behind a bit.

S: (Picks up telephone).

E: Wait a minute Scott (S), 'til Alan's ready.

S: Have you got the motor car, Alan?

This awareness of the other's requirements runs counter to the notion of egocentrism. It is true that the experimenter's assistance as a guiding force is influencing the situation, but this is largely because the young listener is almost entirely passive. When the listener's difficulties are brought to the speaker's notice he shows that he is able to take the other's viewpoint. He knows that the car must come before the telephone for both of them, if a correct solution is to be obtained. For the remainder of the trial he ensures that his message is acknowledged before proceeding to the next block.

And another example with a different group.

Speaker: And this time its with (picks up key) the key (putting it on stick).

Listener: (No response - looks at E).

S: (realising L has made no choice). It's the key.

L: (giggles - puts on key).

If the speaker had been behaving in an egocentric fashion he would not be concerned as to whether the listener had heard and carried out his instruction. Even less would he give an unsolicited repetition of the message. This lack of egocentrism may have something to do with the prior exposure to the materials for some subjects, giving them knowledge to which their partners did not have access. This may have motivated them in some sense to transmit this knowledge to their partner. It will be remembered that this was partly the purpose, or a hypothesis, behind the doll studies. Only there the superior knowledge was an inferred one and possibly not a real one. That is the children were encouraged to feel superior, but in fact the circumstances in which they were placed did not always lead to this feeling. In the present study the experienced subjects have two concrete reasons for feeling in an advantageous position a propos the naive children. They have played the game before and they know how to play it. They are not only familiar with the materials but they are aware that they have properly constructed the 'castle'.

This real degree of confidence may be an important factor in good communication. Equally so might be the task itself. There may be something inherent in these materials which facilitated seriation and this is what Piaget has argued. A further study with different materials would be required to ascertain this information.

As well as the materials themselves, the act of describing the behaviour necessary to carry out the task may also facilitate the process. Certainly the speech needs to be describing an active process if it is to be successful. This is demonstrated in an incident occurring in the first trial of a female-male pair (Elizabeth/Gregor). The speaker
not
(Elizabeth) begins to seriate but does/~~not~~ use of the attached labels

to transmit messages. Her first message is 'the big block' and she adds two further blocks without communication. The listener is not clear about his role and the experimenter suggests to the speaker that she tells Gregor what she has done. She finds this very difficult. The accurate reporting of an event that has happened, even when the results are clearly available, does present problems for young children. Part of the difficulty may be the need to use temporal phrases such as 'first', 'next' and 'then'. But it seems that the speaker needs to be describing the action as she is carrying it out to be effective. Incidentally, this is also an example of the problems this task presents when easily recognised labels for the items are not present (or not used).

Individual characteristics

Some subjects are particularly capable and demonstrate a level of ability that would not have been predicted from previous studies of seriation. Lee, for instance, is a naive subject, but in her first performance as speaker achieves a rapid correct seriation. She does this without getting all the benefits of the perceptual properties of the assembly. That is to say, the usual method of construction is to stack the blocks in a uniform manner as shown in figure 7-1. In this way the

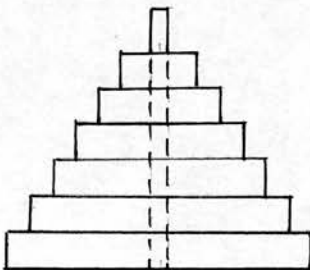


Fig. 7-1

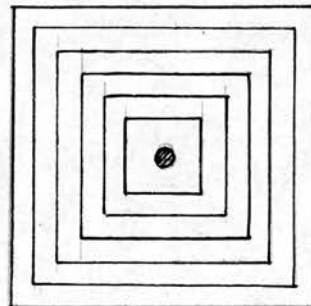


Fig. 7-2

subject sees a pyramid shape being built up which gives some aid in the selection of blocks. The best way to illustrate the difficulties that Lee made for herself is to look at her construction in plan (Fig 7-3) and compare it with the usual finished display in plan (Fig. 7-2)

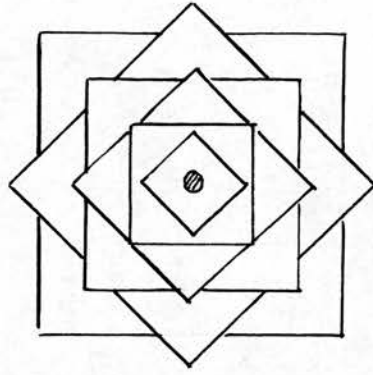


Fig. 7-3

In reality her finished assembly was even less uniform in that each block appeared to be in a slightly different orientation. This was evidently a deliberate ploy, apparently to make things more interesting for herself. Later in the session, when she is listener, she seriates directly on to the table keeping the blocks flush with each other on one side (Fig. 7-4) and says 'I've got my thing like stairs'.

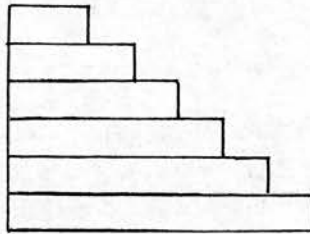


Fig. 7-4

It seems that the stacking peg may assist the seriation task but it is not necessary.

It was stated earlier that subjects need to describe an on-going activity to communicate successfully. While this might be said to be the norm, with exceptional four-year-olds this condition need not hold. In an all female group, the speaker, Clare, starts to tell the listener what she should do without carrying out the actions herself. Since she has been exposed to the task and materials only once before, and then for a very brief period, it seems that knowledge of how to perform the task is present as a plan or scheme. Having carried out the task once previously in a sensori-motor fashion- the necessary information has

been assimilated and a strategy formed. Presumably it is this on which the child draws to predict the operation verbally. She is helped by the materials before her, but these only represent the building blocks of the finished structure in a random order and do not, in themselves, indicate how this structure should be created. When it was explained that she may carry out the task manually, her very competent performance (including the reverse order) suggests that the cognitive operation enabling seriation, at this level at least, is present.

Communicating Seriation - Experiment Two.

The considerable success that was achieved in the first seriation experiment encouraged a further study with materials used in the standard Piagetian task (Piaget, 1952), i.e. graded sticks. It would then be possible to see whether the results obtained in the first study were a function of the material. If it proved to be the case that material which could be said to achieve a 'good' form led to very much greater success in ordering objects, then it would suggest that material properties and perceptual factors in general have an even stronger influence at this stage of development than perhaps Piaget has emphasised. The configurations made by the completed series are shown in Figure 7-5. The outline made by (1) seems, intuitively, to be more

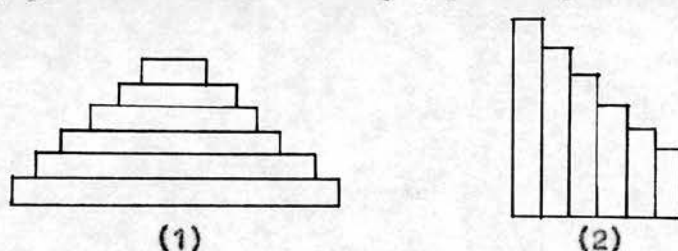


Figure 7-5

'powerful', but why this should be is open to debate. Whether it is a matter of Gestalt laws of perception or simply a question of greater familiarity with one form rather than another, or again a question of experience in actively constructing such shapes will to some extent depend on one's theoretical preferences. Further discussion of this

issue should perhaps await the outcome of the second experiment.

Before describing the Method, a number of differences between this study and those reported by Piaget should be made clear. The intervals between sticks are the same as those used by Elkind (1964), which was slightly greater than that used by Piaget and Szeminska (1952). The number of sticks is less, six as opposed to ten.¹ The procedure of having subjects interpolate intermediate sized sticks in an already constructed array was not administered. The ability to carry out this operation is said by Piaget to be a necessary component of seriation.

A further consideration was the influence of Experiment One on the second study. Piaget's many writings indicate that the processes involved are nothing like as simple as to allow one fairly brief exposure to influence a fundamental cognitive operation. In these particular circumstances such a view may be unjustified and the effects of practice must be watched for in the subjects' performances.

Method

Subjects. Ten children, 4 boys, 6 girls, seven of whom had taken part in Experiment One (see comment below). The age range was from 3 years 10 months to 5 years 2 months, giving a mean of 4 years 5 months. The sample was divided into five pairs for the communication sessions.

Materials. Two identical sets of six sticks, 2.4cm. square and varying in height by equivalent amounts of 1.5cm from the smallest, 7.5cm, up to the largest, 15cm. Each stick had a familiar object painted on it for identification purposes. These were, in order of ascendance: chair, cup, fish, house, train, cat. Small screens for shielding the materials from the view of the fellow communicator.

Procedure. The procedure was identical to that followed in the first

1. It was thought unwise to make two changes from Experiment One, that is type of material and number of elements.

seriation experiment with a preliminary session for half the subjects followed by communication sessions in which both experienced and naive subjects took the roles of speaker and listener. Seriations were carried out in the order learned and afterwards in the reverse order.

Instructions for preliminary session. After getting the child to identify the pictures on the sticks, the experimenter said: 'Now watch what I do. See, we can make these sticks into steps starting with the big one and going down to the wee one (sticks placed upright, one by one). Do you see what I've made?' The sticks were then mixed up and the experimenter said. 'Now see if you can make the steps just like I showed you.' If the child was unsuccessful on this first occasion, the procedure continued in an identical fashion to that of Experiment One with the subject being given successively more help. For full details see Experiment One, page 291, which also gives the procedure followed for the communication session and the overall experimental design. All sessions were videotaped.

Results and Discussion

Before describing and discussing the performances in detail one or two general observations will be made about the findings. Subjects did not handle this task as capably as they had dealt with the blocks in Experiment One. The difficulty was not solely one of communication, The preliminary session, where one member of each pair learned the task, presented more difficulty than it had done in the first experiment, though only one subject failed to achieve the correct order with his first trial. But, although in terms of trials to criterion the performances were identical, it could be seen that the present task was more demanding. Careful measuring behaviour was needed if mistakes were not to be made. In contrast, in the earlier study the differences were such that a reliable estimate of the correct stick was often made without physically putting together the relevant bricks to make the comparison beforehand.

Yet, the dominant impression from the performances in the preliminary session was again one of competence. Some mistakes were made in the course of seriation, but they were noticed and rectified by the subjects themselves.

In the communication session none of the pairs worked together with any degree of certainty. This seemed to be due to two main factors, the constitution of the pairs and the type of material used. Originally it had been intended to use the same pairs of subjects as in the first study, but owing to the absence of some children, new subjects were introduced and some new pairs constituted. There remained seven of the former subjects, including one of the original pairs, so the introduction of new subjects was unlikely to be the whole answer.

The nature of the material has already been referred to in the introduction, and it was suggested that the task might prove harder. An important contributory factor was that the materials in the first study actually appeared to lend themselves to the task in hand. They seemed to possess intrinsic properties which gave the child a good idea of what was wanted, communication or not. To put it another way, if a child was left with these objects and given the opportunity of free play, it is very likely that he would stack the bricks one on top of the other, and almost equally likely that he would stack them on the peg provided. It is less certain, but still quite possible, that the blocks would be stacked in ascending order.

This 'suggestive' property is not apparent in the sticks and clear evidence of this was given in one pair when the naive listener started to place the sticks on top of each other in response to the speaker's instructions. The reason for this was that the speaker omitted the small but crucial words 'next to', and although the omission of these terms did not seem to affect the issue in the earlier study, they were influential on this occasion.

Also tied in with the influence of the materials is the other major fault of the listeners - the order of stick placing. Order has two facets in this context, temporal and spatial. The temporal aspect depends on listening to the speaker and, assuming correct understanding, complying with his request by selecting each item as it is named. As long as the speaker's order is correct, then so should be the listeners. But although each item might be selected in the correct temporal order as instructed, errors could still arise owing to an incorrect placing of the sticks - the spatial aspect. It was this aspect rather than the temporal one which gave rise to most difficulty. Some naive subjects never seemed to appreciate that the sticks should be placed consecutively along the table in one direction and so subjects were often to be seen building up in two directions at once, and sometimes from a third when they inserted sticks within an original line. Although explicit instructions from the speakers could have prevented such errors, equally true is the fact that material such as that used in the first study, would also have prevented it.

Patterns of Performance

Preliminary Session

There was a wider range of performance in this task than in that with the stacking blocks. No subject required the presence of a model to achieve seriation, though one child was taken up to step 3 in the familiarisation session (see Procedure). In marked contrast another child correctly seriated without even needing to manipulate the material. This somewhat striking performance was achieved as follows. The sticks were first briefly presented in the correct order and their ascending and orderly nature was pointed out. The material was then laid flat on the table and mixed up. At this point the experimenter asked the child (Lee) to identify the pictures on the sticks. Her reply was 'It's the cat, a train, a house, a fish and a cup and a chair.' This represented a

verbal description of the sticks in descending order of size - a correct seriation. It could have been that she was merely naming the pictures and the seriation was arrived at by chance. This possibility must be rejected however, for at least two reasons:- 1) If she had been going through a simple naming procedure, she would have almost certainly labelled the objects by some rule of proximity as **did** every other subject. That is, she would have followed the order 'on-the-table' instead of dodging about among the sticks, apparently at random. 2) The way in which the description was given followed a special notation frequently seen in the earlier seriation study. Speakers communicating the order in which material should be assembled, often began with the phrase 'It's the', where 'it' seems to refer to the ordered complex rather than the individual item.¹ Some children were more consistent in this respect than others, and Lee was one of those children. Further support for the idea that this was a genuine phenomenon was provided by her immediate rendition of a correct seriation with the erected sticks at the experimenter's request.

If the behaviour is accepted for what it appears to be, then it is worth analysing for a moment the nature of this piece of cognition. It seems to be behaviour of a fairly high order. The child has successfully

1. What is being suggested here is that the children had a prior concept of the finished array. Whether this was understood as a seriated set of blocks or sticks, or something like a castle is not known. The latter is more likely. But that they had in their mind some formulation of the completed task, represented linguistically by 'it' is strongly suggested. For the purpose of the argument above, however, it is sufficient to say that the speech form used by Lee in the preliminary session mirrors that used in her communicated messages about seriation.

ordered the materials without manipulating them - an entirely mental operation. There can thus be no doubt she has an internal representation of the strategy required. This strategy or plan is unfolded, independent of motor interaction with the materials, to produce the desired result. But this strategy, assuming it is not simply a feat of memory, involves a great deal of mental manipulation and sorting behaviour. The evidence of other subjects has shown that the sticks need to be measured against one another for correct seriation to follow. It can only be inferred that Lee is carrying out this activity as a correct cognitive operation. How does she know when the task is complete? Does she mentally tick off each item as it takes its place in the order? Or as suggested earlier in a footnote does she visualise the completed display and 'slot' each stick into its place until the spaces are filled? This appears to resemble what Piaget and Inhelder (1964) call anticipation.

The possibility that the impressive ordering behaviour was dependent on memory was mentioned in passing. In view of the claims by Soviet psychologists (e.g. Yendovitskaya, Istomina, and Zinchenko, reported in Zaporozhets and Elkonin, 1970) this criticism must be taken seriously. Yendovitskaya says 'A four-five year old child is able to accept a mnemonic goal set by an adult and is also capable of constructing such a goal for himself, especially when conditions of activity favour it'.

The Soviet research has concentrated on memory for momentarily presented objects and also the effects of factors favouring hierarchical organisation of material to be recalled. None of it relates very closely to the present experiment. The arguments for rejecting a simple memory explanation are:

- (1) The limited opportunity available for scrutinizing the individual items and committing them to memory. (The competed seriation was presented briefly to show that sticks

descended from large to small in an orderly fashion).

- (2) Six items is well beyond the memory span of a pre-school child.
- (3) The task required recall not only of an array of pictures, but of an array in a particular order,

As far as the latter point goes, it is true of course, that the task is made simpler by the objects being present, albeit in a random order. To this extent is the memory involved one of recognition or recall? In fact, a memory explanation demands that the order be recalled, but since the objects themselves are present, one assumes recall is facilitated.

Since the original enquiry never set out to investigate such a question (and the behaviour concerned arose quite incidentally out of a familiarising session) nothing can be said with confidence on this matter. It is evident, however, that the hypothesis is open to test.

While the other subjects do not exhibit the startling ability of Lee, their performances are highly competent with the one exception noted earlier. Christine, for example, shows she has a plan in mind when, after erecting the largest stick followed by another large one, she picks up the smallest stick and places it at some distance from the other as if marking the end point of the array she has in mind. The line is constructed by comparing sticks from the pool with those already assembled. The subject's eye movements can be seen scanning the pool for the item which she believes should go next in line. She is able to carry out this operation mentally. That is she doesn't pick out a stick at random, put it next to the last stick in the line and observe if it is the correct amount smaller. This is the procedure adopted by a less able child. When Christine makes a choice she already has a good idea of the worth of her choice. When she stands the selected stick in line it is confirmation she is seeking rather than a decision.

In contrast to this pattern is the strategy employed by Sally. Her choice seems to be based on proximity rather than on any inherent attributes possessed by the sticks. That is the sticks are put up as they come to hand. Even when the experimenter aids her by directing her attention to the largest and smallest sticks, and suggests she uses these as the two pole positions, little improvement results. Success is finally accomplished when the idea of 'next biggest' is given to her, but there remains a strong suggestion of a trial and error solution. The implication of this performance is that the subject will prove an inadequate speaker in the communication situation.

Communication Session

The main findings from this second study of seriation were the adverse effects of the task on communication efficiency and the marked independence or self-reliance of some listeners in the face of information challenging their own viewpoint. The factors affecting and signalling breakdown in communication efficiency will be examined in relation to the present findings and with respect to Piaget's concept of cognitive egocentrism.

Two other issues arise out of the study: the extent to which a successful child in this task can instruct and influence a peer and the nature of seriation as revealed by this approach.

The opening dialogue of one of the communication sessions highlights a major problem for subjects in this second study.

Alan (speaker): "Put them ... stand them up like ... the big one ... then a we ... little bit right up to the big one's shoulder ... and I think ... next one is it? Yes. Now measure that ... then that one, the fish."

Faced with a number of sticks and a verbal message like that above, anyone would be hard pressed to produce something constructive. Because Alan's non-verbal behaviour is omitted, the record is almost bare of

information content - and yet that is the record on which the listener must rely, since she cannot observe the manipulation of the material. The excerpt above takes place over a period of 30 seconds, and in that time Alan erects four sticks. Only when he comes to the fourth, however, does he give a meaningful message - fish - and this is said largely to himself.

A description of Alan's motor behaviour would put some flesh on the bones of the verbal record. It would then reveal his words for what they were - an aid to himself. For Alan was just talking to himself as he engaged in a problem which demanded a large degree of concentration. His words are not instructions directed to an attentive listener. This seems to be a key concept in understanding the performances in this experiment. Although Alan was sufficiently familiar with the communication situation to know what his role was in it, it appeared that the task was such as to cause him to forget or ignore the duties of that role. Seriation in this form, apparently, is not the simple exercise it was in the earlier experiment. The preview session showed that the majority of the subjects handled the task competently. But they needed to bring to it a measure of attention unnecessary in the blocks on rod task. Because of this, the additional burden of communicating the actions to a dependent listener becomes a problem. It overtaxes the system, and as a result is either left out or its effectiveness seriously weakened.

It is self-evident that if a speaker does not provide the necessary information then a naive listener is not going to be able to achieve the desired goal. But even if the speaker does carry out his part of the contract efficiently, success is not guaranteed. It has been pointed out more than once in discussions of the communication process that the operation frequently breaks down because of some inadequacy on the part of the listener. Although his role is passive - he has simply to do

what he is told - it has been suggested that it is this very passivity that is his undoing. A child is most successful in a cognitive task when he is actively involved. When the task appears to offer no scope for action, the child may very well initiate some himself. For example in a dyad where Lee is the speaker (her remarkable competence has already been mentioned) and Paul the listener, a successful outcome would result if Paul simply complied with the speakers instructions. But he seems to feel a need to make a contribution. In the first trial he says "I haven't got my fish up" just before Lee instructs him to place the fish in line. Preoccupation with his own concerns causes him to miss this message and an incorrect solution results (see Appendix G). In trial two he tries to go his own way when in response to the message "train", he says "Well I'm going to put the cup up". Both Alan, as speaker, and Paul, as listener, illustrate how the communication set-up can break down if the subject fails to take account of his partner.

Factors giving rise to communication failure in this task

At this point a brief diagnosis of communication breakdown can be provided. Sufficient records are available to allow some conclusions to be drawn as to the factors which signal breakdown (see Table 7-3).

TABLE 7-3

Causes of communication breakdown and their frequency in unsuccessful trials as a function of role and previous experience of task.

<u>Speaker</u>	<u>Listener</u>		<u>Exp.</u>	<u>Naive.</u>
	<u>Exp.</u>	<u>Naive.</u>		
Stops verbal comm. Absorbed in task	0	2	Not attending, distract- ed	1 3
Selection errors	2	4	Inappropriate verbal comment	1 1
Inadequate comm.	1	0	Independent functioning	0 3
Total	3	6		2 7

In quantitative terms, of the 18 trials which fail to lead to

seriation by both subjects, in only five could the experienced speaker be said to be a major cause of failure, and three of these five occasions are perpetrated by one subject (Sally) who indicated she had not grasped the seriation concept.

The picture emerges that, given an accomplished listener, four of the experienced subjects would always communicate successfully - i.e. communication failure is seldom due to shortcomings on the part of the experienced speaker. As a listener the experienced subject can be helpful, but there are instances where his superior knowledge adversely affects the naive speaker. For example under the heading 'inappropriate verbal comment' in Table 7-3 it is remarks by the experienced listener such as "I've done it already", "I'm doing it right" and laughter at the naive speaker's errors which largely contribute to communicative breakdown.

But it is a fair summary to say that the naive subject is the prime cause of communication breakdown in whatever role he happens to be. From this one would expect the chances of dual success when the naive subject is speaker to be much less than when he is listener. In the latter case the experienced subject has a greater measure of control of the situation which is more likely to lead to a favourable outcome.

TABLE 7-4

Number of trials ending in correct solutions for both subjects (All figures refer to subjects as speakers)

<u>Order learned</u>		<u>Reverse order</u>	
<u>Experienced Subject</u>	<u>Naive Subject</u>	<u>Experienced Subject</u>	<u>Naive Subject</u>
5/11	0/8	3/6	0/1
45%	0	50%	0

It can be seen from Table 7-4 that the naive subject has no success at all in the role of speaker. The success achieved when the naive

subject is in the role of listener does not rise above the 50% level. We need to examine what limiting factors subjects, especially the inexperienced ones, imposed on the situation such that the success rate is relatively poor.

The factors can be briefly stated and then enlarged upon. Abstracting from Table 7-3 they fall into four main categories:

1. Task errors - i.e. mistakes in seriating.
2. Attentional factors.
3. Independent functioning, including passivity,
4. Inadequate messages (excluding Type 1.)

Task errors are those determined by the child's incapacity in the cognitive area under investigation. In Piagetian terms the child tackles ordering problems in a pre-operational manner whether at the stage 1 level of global indifferenciation or the intuitive representation level of stage 2 characterised by a trial and error approach. It is easy to see that the naive subjects who fail to realise what is required when operating in the role of listeners, will make task errors when taking the speaker role. When task errors are made by experienced subjects it is an indication that those subjects have not attained the operational level of seriation. Absence of errors does not in itself imply that the operation of seriation is present, of course.

The category labelled attentional factors covers a rag-bag of behaviour which seems to have attention as the common feature. It may represent the subject's way of compensating for the passive role he seems to have been offered as listener, though this behaviour is not confined to listeners. Some examples will indicate the type of behaviour under discussion. There is the task irrelevant utterance e.g. "I can build a castle", "You can't see where you're going with your peak (cap) down there", "Smell my perfume", "I can do it louder than her" and task irrelevant activity, of which knocking over the sticks was a much favoured instance.

Such a subject showed himself to be easily distracted and seemed to be constantly looking for an excuse to impose his presence on the situation in a manner usually unproductive.

Other causes of breakdown falling within this area were what might be called unhelpful utterances. These were not irrelevant, in that they did concern the task, but they concerned the listener's own idea of the task. There seemed to be a quite strong desire on the part of some children to function independently of their partner.¹ So, for example, the verbal record would appear as follows:-

(Lee) Speaker "You put the cat up"

(Paul) Listener (Stands cat up)

Speaker "And then the train"

Listener "Well, I want to put that" (standing cat up).

"Well I'm goin' ... put the cup up".

This example was mentioned earlier - the child appears to want to bring something of his own to the task. Whether it is helpful to regard this as egocentric behaviour must be considered. But first another example. At the start of this discussion, an excerpt from a verbal record was given which contained very little positive information for the listener (p.314). But the listener, though making no attempt to seek further information, nevertheless attempted to carry out the task as she saw it. She in fact started piling sticks on top of one another and

1. On some occasions this independent functioning was adaptive, for instance when an experienced listener refused to follow the unreliable advice of the naive speaker, but insofar as we are at present interested in communication breakdown, the positive side of independent functioning will be discussed later.

constructed two towers. This strongly suggests that she was making some transfer from the previous blocks-on-peg task in which she had taken part. From this point of view, lacking pertinent information, building the sticks upwards represented reasonable behaviour. To be sure it did not indicate knowledge of ordering behaviour, but nor did it deny this possibility.

Egocentrism as a cause of communication failure.

The Piagetian explanation for communication failure in the areas that have been mentioned would be egocentrism. That is a "lack of differentiation between ego's and alter's points of view, between subjective and objective" (Inhelder and Piaget 1958 p. 343). The fact that the naive listener prefers to do one thing while the speaker is trying to get him to do something else may be described as egocentric behaviour. But having said that, what has been explained? The trouble with a term like egocentrism is that it is used in situations where there seems to be a lack of co-operation between two persons or where someone's view of a situation appears idiosyncratic.

There would seem to be two points to consider. First, is egocentrism a useful term to use? Should we not try to be more exact in explaining behaviour that is said to fall into this category? Secondly, however defined, is egocentrism always the explanation for such behaviour? In the area of behaviour under consideration, is a 'failure to consider the other's point of view' a satisfactory explanation for breakdown in communication in young children? There are, for instance, sound reasons for thinking that in some cases breakdowns are due to a lack of comprehension on the part of the participants. In other cases, a failure to involve the child seems to be a contributory factor. Both of these arguments are supported by the results in the ideal speaker/listener experiments, where an effort was made to overcome these limitations and subsequent improvement in performance resulted.

The Piagetian notion of centration certainly plays a part in this process but it is perhaps better regarded as one aspect of attention and one of a number of attentional factors that ought to be defined as precisely as possible.

We need to know if the cues in a particular situation are perceived as identical by speaker and listener, experienced and naive subject. This is highly unlikely. To give one example, even when speaker and listener are equally familiar with the material, the speaker is put in a special position by being instructed to choose an object and communicate his choice to the listener. As soon as he has selected an item, the speaker's task is facilitated by having the number of competing cues diminished. He can then describe that object without relating it to any other members of the array. If the description is full enough it will be adequate. The listener, however, is subject to all the cues, and his choice, though supposed to be a function of the message he receives from the speaker, may equally be dependent on the salience which the objects have for him. Even if he does systematically narrow down his focus using the verbal messages sent to him, his interpretation of the message is liable to distortion either because of linguistic incompetence, that is being unable to relate word to referent, or through the compelling influence of perceptual cues, outweighing the power of the speaker's communication (see Donaldson and Lloyd 1974). What this amounts to is that he is told to select one item but chooses another because its size, colour, texture or whatever, captures his attention.

It would seem, therefore, that the relative failure of the naive subject and the subject as listener might be explained by attentional factors, comprehension difficulties and lack of active involvement. According to Piaget, egocentrism is a pervasive feature of the behaviour of pre-operational children. "It is only when the child

reaches the stage of concrete operations (7 - 8 years) ... he acquires skill in inter-individual relations in a co-operative framework. Further, the acquisition of social co-operation and the structuring of cognitive operations can be seen as two aspects of the same developmental process." (Piaget, 1963).

When the performance of the children in the communication task is examined in the light of this statement, many counter examples to Piaget's hypothesis appear. Perhaps the most overwhelming evidence is that four of the five experienced children in this study successfully communicated the method of completing the seriation task such that the outcome was a mutually correct solution. Additional evidence from the whole series of studies makes this claim an even more substantial one. So, it is maintained that the degree of co-operation required and achieved for success, in what must be considered a fairly complex task, does much to weaken the Piagetian argument concerning egocentrism.

Let us consider some more specific instances. Linda is the naive listener, Alan the speaker familiarised with the task. They are seriating in the reverse order (chair, cup, fish, house, train, cat).

Alan: The chair (stands it up)

Linda: The chair (bangs it down on table) The cat (looks up at Alan)

A: No

L: The house?

A: Cup! (stands it in line)

L: Cup (puts it next to chair) The house

A: (puts house against cup and discards it - probably not in response to L's suggestion. Picks up fish and checks it against cup)

L: (repeats) The house? (half question, half assertion)

A: No, the fish (putting it in line)

L: Fish (putting down house and standing fish next to cup)

The house?

- A: Yes, house (having first checked train against fish)
 L: (adds house to line) Now the cat? (going to pick it up)
 A: No, the train (both put it in line)
 L: Cat now (picking it up)
 A: Yes (both finish seriating)

Note that Linda makes a series of challenging assertions in this trial, most of them incorrect suggestions, but Alan manages to resist them and to communicate the correct choice. It might be argued that this is an example of egocentric behaviour. But the record shows that he is fully aware of his partner and considers her suggestions, so we get an exchange like 'The cat' - 'No' - 'The house?' - 'Cup!' and again 'The house-' - 'No, the fish' and later 'The house?' - 'Yes, house' - 'Now the cat?' - 'No, the train' and so on. And just as Alan is taking account of his partner's point of view, so also is Linda. Indeed she is having to do so in a much more wholesale fashion, since she is having to reject or inhibit her own point of view and adopt that of her colleague.

Another example is provided by a different pair, Lee and Paul. Lee is the speaker and is describing seriation in the reverse order (chair, cup, fish, house, train, cat) after a number of trials in the other direction big - little. Paul is rather slow at assembling the sticks and after announcing the third stick and observing a fair amount of activity on Paul's part, Lee says "He's getting mixed up 'cos I put the cat first before, eh?" This seems to show not only a remarkably mature assessment of the seriation problem, but also behaviour far from egocentric. Lee has recognised that the change in order could lead to difficulties for the other child and as such has demonstrated a degree of perception much more sophisticated than the theory of egocentrism would predict. Later in the trial the dialogue is as follows:-

Lee: Now the train (stands it in line)

Paul: (Puts the train in line)

Lee: Have you got the train up?

Paul: I've put it up.

Once again Lee is showing a concern for the other child, a degree of co-operation not generally thought to be within the compass of egocentric children. The issue of egocentrism will be taken up again in a general discussion of the findings.

The Experienced Listener Independence Hypothesis

There is a factor which signals a breakdown in communication which has not been discussed up to now. This is independent functioning of a positive sort. It is positive because it is instrumental in the subject achieving a correct solution in the face of unhelpful or inadequate information. At the same time it signals breakdown by indicating that the listener has lost faith in his partner's communications and will continue to function independently. In practice the behaviour shows itself by a reduction of exchanges, and by the listener continuing to build up the correct solution without any instruction or in disregard of any instruction. In some cases the experienced listener seeks to change the message or selection of his partner, and in this way correct descriptions are achieved which would otherwise have failed. In Table 7-5 correct solutions attributed to naive speakers are those achieved by their own efforts.

TABLE 7-5

Number of correct and incorrect descriptions or solutions in the
seriation task.

<u>Descriptions/Solutions</u>	<u>Order Learned</u>			<u>Reverse Order</u>		
	<u>Correct</u>	<u>Incorrect</u>	<u>T</u>	<u>Correct</u>	<u>Incorrect</u>	<u>T</u>
Experienced Speakers	8	2	10	6	0	6
Naive Listeners	5	5	10	3	3	6
Naive Speakers	1	7	8		1	1
Experienced Listeners	5	2	7*		1	1

* One short since N.S. not able to complete descriptions and so
E.L. does not complete trial.

The table shows that although only one correct series of descriptions is provided by a naive speaker, five correct solutions are achieved by the experienced subjects. This behaviour might almost be expressed in the form of a hypothesis: the experienced listener independence (ELI) hypothesis. This states that: the listener will always rely on his own judgement rather than that of the speaker when he knows that the speaker is wrong. Ironically enough, on the one occasion when a naive speaker achieved a correct solution, the experienced listener arrives at an incorrect solution. This seems to suggest that the hypothesis might be more strongly worded by leaving out the rider 'when he knows that the speaker is wrong'. One should be cautious about this, however, since this particular experienced listener was the least accomplished and confident of the subjects familiarised with the material. Furthermore she did in fact ignore the ELI hypothesis and attempt to follow the speakers communications. However, since the naive subject was solving the task in a trial and error fashion, and was not always reporting the changes he made, a correct solution was never possible, purely on the basis of

his verbal messages. Strictly speaking therefore, no correct descriptions were provided by naive speakers as pointed out earlier in the discussion on causes of breakdown.

The table also shows how consistently correct the experienced subjects were when carrying out seriation in the reverse order. One further point to note from this table is the sparsity of data in the bottom right quadrant. This is because the experiment was carried out in one session and most of the subjects were thought to be either too tired or too disinclined to complete a trial as naive speaker. It must be remembered that these are the subjects who are likely to find the task most frustrating as they are relying on their peers for information about it. This degree of sacrifice in data was thought to be preferable to bringing the subjects back on another occasion when other variables might affect the issue. In any event, there is no reason to believe that the trend would have been significantly different from that shown under 'Order Learned'.

The Placing Problem

A feature of some performances, which was mentioned in the introduction to the results, was the problem presented by the spatial ordering of the sticks. It was pointed out that even if the listener correctly followed the spoken or temporal order given to him by the speaker, he could still fail to arrive at a correct solution by placing the sticks in the wrong order. The experiment could have been designed to eliminate this possibility, that is, a piece of apparatus (a holder or slot of some sort) could have been provided, obliging the listener to place the sticks in the serial order in which he selected them. This would have made the task very similar to the first seriation experiment, where spatial order was dictated by the material used. But since the point of the second experiment was to remove this constraint and make the task similar to the standard Piagetian problem, it was thought desirable to discover

how the children would handle this extra dimension.

An examination of this behaviour needs to be divided into the familiar categories of speaker and listener and experienced and naive subject. The onus is on the speaker to make it clear how he wants the sticks placed, as well as the order in which they should be erected. None of the speakers appears to have fulfilled this function. This is not surprising considering the kind of abstract terms that would be required to describe verbally such a procedure. To some extent it means putting into words the essence of the operation itself. Seriation is more than just standing up sticks when told to do so, it also requires that the sticks are assembled within a particular spatial configuration governed by size and order such that there is a unidirectional uniform progression. Success occurs where the listener happens to adopt the uniform approach shown in 'A' of Figure 7-6, since, as has been pointed out, no cues are provided by the speaker. 'B' and 'C' represent examples of the non linear approach which was produced by one subject who nevertheless followed the temporal order implicitly.

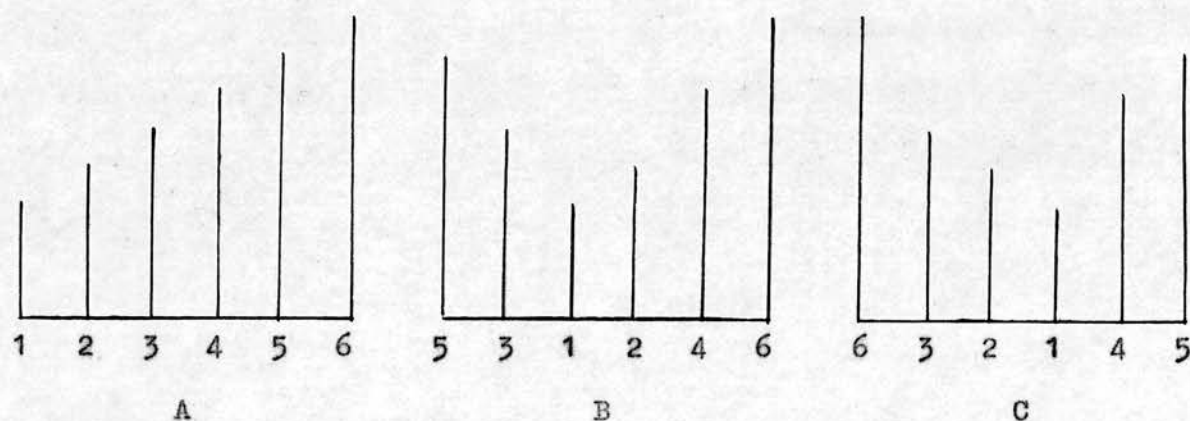


Figure 7-6

After the listener (Linda) had produced an incorrect order for the second time (C), the experimenter asked the speaker (Alan) if he could tell Linda why she was doing it wrong. He replied 'Well, it's supposed to go like this', running his hand along the top of his line of sticks (A). (This was at the comparison stage at the end of a trial, when each could

see the other's set of sticks).

Other naive subjects also placed the sticks in an idiosyncratic manner and some combined this with mistakes of a selection nature e.g. selecting fish when speaker said house. Whether this was done on the basis of personal preference, misunderstanding of the speaker or some other reason was not always clear. What was sometimes evident was choice based on proximity - that is to say the child would select and stand up a stick as it came to hand. This was a particularly noticeable strategy by naive speakers who had obviously not grasped the nature of the task.

By examining these errors in terms of selection and placing, one begins to acquire an understanding of the various strategies adopted by naive subjects. At one level there were those children who appeared to have no grasp of the problem. The task as they understood it was to stand up sticks. At a slightly higher level there was an attempt to stand up sticks in some sort of line but the order in which the sticks came to hand, i.e. proximity, tended to govern choice. It would be these subjects, levels 1 and 2, who would be operating in an independent manner as listeners and in a completely non-constructive fashion as speakers.

Level 3 is represented by an awareness of the requirements of the task in as much as there is a serious attempt to follow the order given by the speaker. The fact that success is still not assured may be due, after Donaldson (1963), to executive errors - the subject picking up the wrong stick 'by mistake'. Observation alone is not enough to determine whether in fact these are executive errors. All one can say is that some subjects appear to be monitoring the speakers' messages and responding to them promptly, but that they occasionally pick up the wrong stick. Such errors are not wildly wrong, being usually removed from the correct choice by one. If it could be established that such errors were merely slipups, there would arise the interesting question of whether such a subject was

operating at a higher level than the child who erects sticks in the transmitted (and correct) temporal order but places them idiosyncratically. In this context it is necessary to distinguish between trial 1 and the later trials, since after trial 1 the listener sees the finished product and has the opportunity of a 'model' from which to work.

Caution should be exercised here, however. The sort of evidence that would be needed to attempt an objective assessment of these children's seriation ability is a post test of seriation following the instruction by the experienced subject. This would show how effective this instruction had been. A post test has been built into the experimental design, since the naive subjects are asked to perform as instructors after a spell as listeners. It has already been shown that in terms of successful seriation the results were negative. However, performances varied and it is of interest to know if the performances as speaker in any way corresponded to those as listeners.

In a communication task such an assessment is complicated by the influence of an extra variable in the situation - the other child. In this case the other child was the experienced subject, who might be expected to make a contribution. This, in fact, he very often did, and mistakes or hesitations on the part of the naive speaker were frequently rectified by the more knowledgeable child. The result was that only one naive speaker achieved a correct seriation unaided and he failed to communicate this solution adequately. The reason for this child's success is not hard to find. He was paired with the least able experienced subject, and the attainment of the goal unaided was a function of the listener's inability to aid him. It is nevertheless noticeable that none of the experienced subjects contributed to or contradicted the naive speaker until errors were made. It was very much a case of the experienced listener monitoring the speakers instructions and only passing comment when they failed to match his own conception of the task. To this

extent the communication procedure could be counted a success because it greatly minimised the number of errors. At the same time the presence of the second child reduced the opportunity for the naive subject to work out a solution by trial and error in his own time. When such an opportunity was available, one subject was able to grasp it as we have seen above.

The correspondence, then, between performance as listener and speaker, by the naive subject, is difficult to assess. An examination of the records shows that those subjects who, as listeners, make primarily errors of placement (Linda and Paul) continue to do so as speakers, but as speakers they also tend to make errors in the order of selection. This indicates that their understanding of the task was not only being limited by a failure to appreciate the direction of placement. The misapprehension seems to go deeper than this. Of the other two subjects, two of them (Anna and Elizabeth) receive a degree of assistance that prohibits a comparison. Comparison of the performances of the child who eventually seriated correctly is also hindered. As listener he received inadequate guidance and therefore it is difficult to differentiate his own predispositions from those directly acquired from the speaker. Of all the children his performance is in some ways the most remarkable for he successfully completed the task without ever having witnessed (verbally or visually) a correct solution. His hold on the problem, however, is shown to be tenuous when he fails to seriate in the reverse order.

Communication Development in Miniature - a case-study approach

An opportunity provided by the present study is that of observing the course of a communication pattern as it evolves in the brief duration of an experimental situation. What we have is a sample of behaviour involving two children who, in theory at least, are combining to solve a problem. The relative spheres of influence or degrees of participation

vary as a function of role (speaker or listener) and familiarity with the problem (experienced or naive). A longitudinal analysis of the record of each pairing might provide an answer to a number of questions. Does the operation of roles vary in the course of the communication session or are they constant? Does the naive subject remain uniformly passive or does his performance fluctuate, and if so, why? How does the actual interpersonal relationship between the children develop? Do the constraints of the situation affect the task positively or otherwise?

In order to try and answer these questions, the record of one pair will be described in some detail and then some more general conclusions based on all the sessions will be offered. In the pair under scrutiny, Lee is the experienced subject, female (age 5y. 1m.) and Paul the naive subject (age 3y. 11m.) Lee demonstrates a high level of ability in the preliminary familiarisation with the problem and therefore Paul had a potentially good chance of acquiring the necessary information to carry out the task.

The data required for this analysis is all taken from the videotape of the session. This has been abstracted in various ways in written form and can be found in Appendices F and G.

The early exchanges are controlled by Lee as speaker and she functions efficiently as expected, e.g. her first message is 'You put the cat up'. 'Up' is a crucial word at the start of the session when the naive subject is completely unaware of the nature of the task. Not only does he need to know which stick to select but also what he should do with it. There is a breakdown at the very beginning, however, when it is clear that Paul is unsure of his role in the game. He does not remark on his own ignorance and as a result does not act on the message given to him. After a suggestion from the experimenter, the session gets under way. Paul fails to seriate although all the necessary information is

provided. His failure is of two types - firstly, attentional deficiencies causing him to miss a message and, secondly, idiosyncratic placing of the sticks. The attention factor is not due to distraction caused by boredom or lack of interest - it is rather too much interest in his own array. He has not yet fully realised the implications of doing two things at once - building up a line of sticks, and listening to and acting upon a series of messages. The two activities are of course interdependent, particularly the first (build-up) on the second (monitoring messages). If anything Paul proceeds in the opposite order and if he is absorbed in building, messages are liable to be missed. As a check of trial 1 shows, fish is the critical message that fails to penetrate Paul's 'filter', to borrow a metaphor from the information theory approach to selective attention. The difficulty of achieving the correct spatial order has been discussed earlier and typically the listener receives no information from the speaker about spatial distribution. Apart from his one lapse, however, Paul does erect the sticks in the transmitted temporal order.

There are signs in Trial 1 that Paul is resenting his passive role and in Trial 2 he tries to assert his independence by suggesting alternatives to the orders coming from the speaker. His suggestions are inappropriate and the trial is abandoned. The behaviour of Lee in Trial 3 is noticeable for its consideration towards the listener. In the first two trials Lee went through the motions as speaker, always giving adequate information, but not otherwise taking much account of the listener. The change of approach may be due to the experimenter who suggested she went a bit slower for Paul. This she does, making sure he has received and acted upon the message before giving a new instruction. A correct trial results. This is not to say Paul's lack of success in the earlier trials was due to an insensitive speaker. The fact that he is becoming familiar with the demands of the task, not least the sort of motor manipulation

required, will also affect his performance. Probably most important is the fact that he manages to restrain his own impulses to function independently.

The first trial (4) where Paul acts as speaker exposes his limitations. The first point of note is that he starts communicating adequately but makes no attempt to construct a line himself. Is this another example of not being able to carry out two functions simultaneously? The demands of one excluding the other. Or, is it that Paul does not fully appreciate the role of the speaker - that he must construct a line and tell his partner what he does? Since he has already taken part in a number of trials as listener and seen the speaker's completed array at the end of each trial, this explanation does not seem likely. After Paul has been reminded of his duties as speaker, he proceeds to provide adequate information about the first four sticks he puts up. His strategy appears to be based on proximity rather than seriation, however, and Lee erects sticks according to her own criterion when Paul starts to make errors. Her reaction when Paul makes his first error, on the third stick, is of interest. She ignores the instruction 'Put the chair up' and picks up the correct stick, house. Before putting this in line she hesitates, apparently to see if Paul changes his mind. It is only when Paul's next message fails to amend the situation, that she decides to continue under her own direction. To some extent this has been the case from the beginning of the trial, since Lee had chosen the correct stick before Paul's message was received. But she nevertheless waited for his message before standing up the stick. It was not that she wanted confirmation of her choice, but rather that she wanted to be able to confirm ~~his~~ choice - to be certain that the two arrays were proceeding in a like fashion simultaneously. In this sense the communication situation seems to be an endeavour involving two people in some sort of partnership,

for some children at least.

As has been said, Paul was proceeding confidently when he noticed a discrepancy. From then on his behaviour is far from confident. He is aware that mistakes have been made (the chuckles coming from the other side of the table may have contributed to this awareness), but is not clear how to remedy them. He attempts to put things right but in his words is 'getting mixed up'. He removes a stick, inserts another, switches another one and ends up looking confused with a stick in each hand. Most noticeably, his verbal communication ceases altogether. Once again, when things become difficult, when extra concentration is required, the verbal flow dries up.

In the following trial (5) Paul begins as before and makes the same error as before. Lee seems amused by his mistakes and her somewhat derisory remarks (see Appendix 6) probably serve to confuse Paul even further. The consideration she displayed as a speaker, earlier, is not apparent as a listener. This is possibly due, in part, to the sense of impotence the listener has in the face of an inadequate speaker. It is possible to keep one's own house in order, but it is not so obvious how the speaker might be helped. One method is to point out mistakes as they occur e.g. 'No, not chair, house'. We've already seen that some listeners adopt this tactic. For some reason Lee is disinclined to play this role. Later she does so at the instigation of the experimenter.

On this occasion when Paul seeks to recover the situation, his role as speaker does not break down to the extent it did in Trial 4. On two occasions he tells the listener to 'wait' while he tries different manoeuvres. Whether this is Paul indicating awareness of his responsibilities as speaker, or a more basic desire to re-establish his authority, must remain a matter for conjecture. Lee has by this time completed her line and the experimenter suggests that she helps Paul 'You tell him if he's got them right'. With undeniable logic Lee replies. 'How can I see with

the screen up?' as if to emphasise egocentricity on the part of the experimenter! The trial ends with Paul in a state of perplexity and no nearer a solution.

The following trial (6) represents something of a compromise. The material situation is left as it is but Lee becomes speaker and is asked to tell Paul how she has assembled her sticks so that he can arrange his in the same way. So instead of dismantling the structure altogether Paul is asked to build on what foundations he already has. The operation is not a success. It seems that the configuration of his partially erected series serves to confuse rather than assist the listener. Instead of being able to concentrate on the speaker's message and base his selection on that message, he is distracted by the properties of the series. It has been pointed out earlier that the various dimensions existing in any set of material are all potential influences on performance. From this trial we can see that those influences are accentuated when a particular sort of configuration is present. In the standard situation, the sticks are lying in a random manner and the listener selects according to the message received and any other factors, properties etc., which might affect his choice. In the situation obtaining in this trial some of the sticks are standing in a line and are thus part of the goal or solution that the subject is seeking. Therefore it would be reasonable to assume that these sticks carry more 'cue weight' than the sticks left in the pool. Paul is able to follow Lee's instructions as long as she is describing what he has in his series, but as soon as her word and his referent no longer correspond, a conflict develops. The force of what he is told, the word, is in dispute with the solid object he has in front of him. So, when Lee says 'cat', then 'train', Paul is able to point to these in his series. But when she says 'house', he at first says 'Yeah' and points to the cup, which is next in his line. Then he recognises the mismatch and searches for the house in the pool. He finds this but

doesn't know how to go about putting it in position. The cup has first to be removed, and he hasn't received any instruction about that. In other words Lee's description is not appropriate to his situation. In a more profound sense we can say that this is a basic problem in so much of the field of study in cognitive development. One person's description (usually the adult experimenter's) is not appropriate to another person's situation (usually that of the young child.)

Paul is not able to overcome this problem and he spends some time trying to impose some order on his sticks, but only succeeds in discarding them all, except the cat, eventually. This helps him in the next trial (7) because he is virtually back in the conventional communication situation. He achieves a correct seriation with the help of a patient speaker. It may be that Paul's confusion and dismay in the previous trial - 'I'm getting them wrong', he says at one point - has an effect on Lee. Certainly for the rest of the session she is patient and solicitous towards her partner. This and the final trial show increasing competence on the part of Paul. As before there is a critical moment when the message does not match his array. He has the cat standing, but when train is transmitted he has trouble locating the relevant stick. It is not standing and it is upside down (i.e. picture not showing) in the pool. The experimenter is obliged to turn it over for him. After this he succeeds in following Lee's instructions, but would very probably have been in difficulty with a less helpful speaker.

The final trial (8) has Lee instructing Paul in seriating in the reverse order. They both take it gently, with Paul having to concentrate for this unfamiliar order. The degree of application of both children is remarkable considering that they are at the end of a lengthy and demanding task.

FOOTNOTE -Implications for seriation

It was never a serious aim of this study to add anything to our knowledge of the seriation process; the sample size is too small and the differences between this and other studies are too great. Nevertheless the temptation to try and place these findings in the context of mainstream theory cannot be resisted.

The most notable feature of the present findings was the success achieved by this sample of four year olds. It certainly seems to be greater than a direct prediction from Piagetian theory would suggest. Accepting that the test has not been rigorous enough to satisfy an unequivocal claim for seriation, the fact remains that these children demonstrated accomplished ordering behaviour. Piaget would want to argue that the size of the interval between elements and the perceptual configuration made by the finished array accounted for this result. It must be admitted that the configuration and the intrinsic properties of the material used in Experiment One probably affected performance. But seriation was carried out in the reverse order just as capably and the inverted triangle configuration would not seem to be such a compelling form.

In Experiment Two the configuration argument does not apply. At least it has not been used by Piaget in his interpretation of results in what for him is a standard situation, i.e. ascending sticks. The reduced number of elements and the slightly larger perceptual differences may account for the success, though it is unlikely that the degree of confidence shown by some subjects was due to this alone. A possible influence is the picture on each stick for naming purposes. Although these pictures are not correlated with size, it may be that they facilitate the task in some way, perhaps by assisting a mediating process. Piaget, however, has frequently used different coloured sticks in the seriation

task and has not commented on such an influence. Piaget and Inhelder (1964) did in fact find that anticipation of serial order by drawing was achieved, in one colour only, before the correct correspondence between colours and size was made.

In their discussion of seriation, Piaget and Inhelder remark:

"... we might have found a marked improvement in the seriation ... had we used fewer elements, or if there had been greater differences between the elements. But either of these variations would mean that we were measuring a perceptual adjustment to an intuitive whole instead of operational reasoning." (Piaget and Inhelder, 1964 p. 251).

There is a suspicion that the notion of intuitive wholes is a somewhat speculative inference to account for certain behaviour which cannot be contained within the operational framework. If they are the explanation, then they deserve further study, for on the evidence of this performance they are powerful forces which give rise to quick, accurate, two-way seriation.

Another factor not considered up to now is the possible role of language. In an intriguing 'aside' Piaget and Inhelder say:

"Seriation ... is somewhat improved by verbal training, because then the linguistic process also relates to the act of comparison and therefore to the concept itself." (Piaget and Inhelder, 1969, p. 90)

They do not really enlarge on this statement, but there was certainly some short but intense 'language experience', if not verbal training, in the communication task. Again there is a suspicion that Piaget is trying to cover all possible eventualities, in assigning an unexplained role for language. If such conceptual understanding can be improved by talking about it, at an age when, for Piaget, the role of language is inconsiderable, this provides support for theorists such as Bruner and Vygotsky. For them language is a prime factor in the acceleration of cognitive growth from about four or five years.

The significance of the present findings would seem to be the demonstration that young children are able to use efficient strategies to solve relatively complex cognitive problems. Having done this they are also able to instruct other young children so that they, too, master the task. If Piaget is right, and this behaviour is a function of intuitive and perceptual factors, can we be sure that they are only a primitive form of reasoning and do not continue to play a significant role in cognitive development. Eleanor Gibson (1969) is sceptical of the view that perception simply gives way to inference, and prefers to say that our efficiency at extracting invariants from the stimulus flux increases with experience. This is dependent on such things as improved attentional strategies and perception of distinctive features. If we also accept that different stimulus situations possess intrinsic properties which cause them to be interpreted differently, even if there is an underlying common relationship or concept, it may help to explain some of the performances we have seen in a number of these studies.

Chapter 8 Conclusions.

This work had six main aims which were stated in the Introduction. It is time to see to what extent they have been achieved. Before drawing conclusions it is necessary to point out once more that, because of the special conditions obtaining, many of the points that will be made are in the nature of hypotheses which should be tested with a larger population.

1. Communication abilities of pre-school children in discrimination tasks.

This aim refers to the quantitative findings on communication and is dependent on the measure of communication ability used. Glucksberg et al. (1966) used the number of trials it took speaker and listener to achieve a matching set of objects as their criterion of communication ability. This seems a somewhat gross measure and may not represent the real level of ability, that is it does not differentiate between speaker and listener. The preferred measure in the present studies has been message adequacy - the extent to which a message is able to specify the intended referent. A listener's ability is measured by the extent to which he is able to act on adequate messages. There are also qualitative indices of communicative success and these will be discussed in the next section.

It will be remembered that the conclusion reached, based on a review of previous research in the area, was that pre-school children possessed little or no communication ability. The results of the present research do not support this conclusion. It is impossible to be categorical, however, since communication ability has been shown to be sensitive to the situation in which it occurs. The task, including the type of material, and the nature of the communicating partner have been shown to be particularly influential. Equally important is the manner of the presentation and/instructions used.

In terms of message adequacy three experiments (Houses, Chapter 4,

Study III, Chapter 5, Talking Doll - 1, Chapter 6) showed a success rate between 37.5% and 46%. This compares to Glucksberg et al's figures of of no errorless trials by pre-school children. (It is not suggested that these results can be seriously compared to those of Glucksberg et al. because of both task differences and types of measurement used. They are being included, however, as/the only communication study with a similar age group). The level of message adequacy is remarkably consistent, considering the differences in materials used and the type of partner (peer, adult and doll), and suggests that it is a fair reflection of communication ability by speakers in this sample. The individual data indicated a wide range of achievement with approximately equal proportions of high, low and average ability children. In the study which investigated more abstract verbal ability (Talking Doll - 2, Chapter 6) the level of success dropped to 26% indicating that it was the most demanding of the tasks.

Listeners' abilities were assessed according to the extent to which they could respond to adequate messages. Another index of listener competence was the degree to which they could recognise, and make good, inadequate messages. They had to be information seekers as well as processors. When paired with peers, children managed to identify two-thirds of adequate messages but made little or no effort to obtain further information on inadequate messages. When paired with an adult speaker who provided just enough information to enable discrimination, three-quarters of the children achieved at least one errorless series out of two, the overall error rate being only 17% Glucksberg et al. found that two-thirds of their sample identified blocks described by adults, and Grushhow and Gauthier (1971) report a similar figure, although in their case the messages contained a considerable amount of redundancy.

The talking doll studies measured the information seeking capacities of the children. As listeners they were required to obtain two missing

attributes to discriminate chosen blocks. A success rate of 35% in both studies was therefore impressive.

Another aspect of communication is the speaker's ability to profit from feedback, i.e. to modify his description when the listener indicates it is inadequate. This implies that the listener is able to signal the inadequacy of a description, something the child was not able to do in the peer situation. When partnered with an ideal listener, nearly three-quarters of those messages which were not initially adequate were modified by child speakers. These figures represent an improvement on the findings of Glucksberg and Krauss (1967) as far as it is possible to compare them. It was not possible to monitor modification of messages in the talking doll studies, but inspection of the data indicated that only a small proportion of the children failed to introduce any modification of inadequate messages. The degree to which this modification was successful corresponds to the number of descriptions which subsequently became adequate. In the blocks task (Chapter 6, Experiment 1.) 90% of inadequate messages were modified but of these 60% provided only one, instead of two, additional attributes. It should be pointed out that the number of items in the array was greater in this task, thereby increasing difficulty, and the talking doll was a less able partner than the ideal listener.

How then can we summarise communication ability as measured by the three criteria of message adequacy, discrimination based on sufficient information, and degree to which information can be sought when messages are inadequate? The conclusions must be that over this range of tasks:

1. Between one-third and one-half of messages sent allow a listener to know which, of a number of objects, is being specified.
2. As long as messages are adequate listening children perform well, but not perfectly. Between two-thirds and three-quarters of such items are correctly identified.

3. Although poor at signalling the inadequacy of a message spontaneously, listening children will work hard at deriving more details in an appropriate situation, i.e. with a talking doll.

4. When they are told that their messages are inadequate, nearly all speakers provide additional helpful information.

As communicators pre-school children may be some way short of competence, but they are considerably more accomplished than previous theory and findings predicted. Many children in this sample have shown that far from being unable to converse and co-operate productively, they can understand and talk to one another, to adults and to a talking doll. Not unnaturally the degree of effectiveness varies according to the topic of conversation. The more complex the message, the larger the number of alternatives present against which to relate the message, and the more abstract the referent, the greater the likelihood of ineffective speech. It is argued, however, that both Piaget and Krauss and Glucksberg seem to have underestimated the level of communication skill in children between three and five years. In the case of Krauss and Glucksberg it has been suggested that this may partly be due to using a task unsuitable for the purpose and a measure not sensitive enough to give an accurate picture of the behaviour.

2. Qualitative analysis of communication abilities & strategies of speaker and listener.

Qualitative analysis is a sophisticated expression referring to discovering the way someone goes about doing something, for example, solving a problem. In this case the problem is taking the role of speaker and listener in a communication task so as to achieve the perceived goal. Because the behaviour in question cannot be reduced to a statistic, or possibly because it is not considered informative to do so, it becomes necessary to present the data in a different form.¹ Perhaps the

1. This does not, of course, mean to imply that figures are never used in qualitative analyses.

best examples of subjecting behaviour to qualitative analysis are certain computer programmes. Here the idea is to specify, as precisely and exhaustively as possible, the procedures followed to achieve a certain end, as for example the analyses carried out by Klahr and Wallace (1972) of the performance of children in some Piagetian tasks.

The analyses that have been presented here, in no way approached the sophistication of Klahr and Wallace's programme, but they have been attempts to represent the strategies followed by children as they played or wrestled with the games they were given. They have been based on inferences made from videotape records of the behaviour concerned. Although every attempt has been made to remain faithful to the records, it scarcely needs to be said that the opportunities for fallacious inference, or perception even, do exist. For this reason, wherever possible, extracts from the protocols have been provided for the reader to see on what the inferences have been based. To repeat a point made in Chapter 2, it can only be said that, for this author, they represent the best means available for saying something about the way young children behave in the communication situation, without doing a total injustice to the complexity of that behaviour.

It would be unproductive to try to review the various strategies which emerged for handling different tasks; instead one or two theoretical issues will be discussed.

Among the predictions arising from Olson's (1970) model was the suggestion that utterances do not exhaust the potential features of the perceived referent, but specify it sufficiently to enable the listener to differentiate the intended referent from the alternatives. The implication of this for the tasks used is that the message should decrease as the number of alternatives available decreases, since the number of features needed to differentiate one block from the others will lessen. It was an analysis of the strategies used by speakers in an early study (Pilot Study - 2)

which first showed how in fact young children operated in these terms. In brief, the number of features reported did not decrease as a function of pool size. An 'ideal' strategy for speakers was constructed based on the minimum amount of information needed to differentiate target items from the remainder as the size of the array decreased. Summarising a number of studies, the findings were as follows:

1. Critical or changing attributes did not reduce along with number of alternatives, i.e. children were not 'ideal' speakers.
2. Number of messages, i.e. discrete utterances about any one referent, did reduce as the array diminished. This suggests that children learn to say what they want to say in a shorter time.
3. It follows from the above that speakers will become more efficient from the listeners' point of view by including the information in one or two messages instead of three or four.
4. An exploratory study with adults, carried out by the author but not included here, showed that critical attributes reported did not reduce along with number of alternatives.
5. Unchanging, or totally redundant, features did not appear in adult's messages. Those children who included such features tended to be consistent and reported them in every description.
6. All children reported critical features first in messages (see sections 3 and 5 below).

These findings broadly support those of Ford (reported in Olson, 1972). He too found that message length remained constant though the number of features needed varied. Neither Ford nor Freedle (1972), working with adults, had number of alternatives (and therefore critical features) reducing across trials. In their studies they were either increasing or randomised. Ford found a tendency for number of critical attributes to increase, but not to match the ideal strategy for four year olds, as number of critical features required increased from one to three. But

in a presentation randomly varying the number of features needed, message length was constant.

There is a possible danger of confusing an ideal message with an efficient one. Since work with adults shows that a constant message length is maintained, it suggests that it is more efficient, unless words are at a premium (as they are in the well-known example of the telegram writer), to repeat all the changing features on each occasion than pick out only the necessary ones. The difference between adults and, at least some children is that the adults restrict themselves to changing features. There would presumably come a point, for adults, where the number of critical features was such that the speaker would find it more efficient to restrict the size of the message. Freedle's (1972) findings suggest that this is what happens, but Freedle was investigating written communication, where it could be argued the coding operation and the demands on economy were different.

So, although children are not functioning in accord with Olson's model, they do approach it. Changing features tend to be reported first, irrelevant information drops away for the older and more able children and in some tasks (Talking Doll - 1) is not included at all.

Further support for the Olson model comes from the persistent strategy to include features, but only certain features, which were not present. In the Houses task (Chapter 4) it was noticeable that houses with no smoke coming from them were described as having no smoke. Although a relatively minor finding, it is of interest because it was not clear if young children would subscribe to Olson's postulate of specifying the intended referent in relation to the perceived alternatives. It was unlikely that they would have referred to no smoke on some houses, if there had not been smoke coming from other houses. They might, for instance, have talked about houses with no curtains but did not, presumably because there were no houses with curtains. This general finding held for other

task situations where there was a feature that appeared on only some of the items. An assumption of information theory is that decisions involve binary choices - a thing is either square or not square, big or not big, with a hole in it or without a hole in it. It may be that processing information in this way is present from an early age (see Simon, 1972).

It has been argued by Flavell et al. (1968) that pre-school children are poor at communication because they fail to take account of the other's role attributes. The findings reported here suggest a speaker can perform well if it is made clear to him when a message is inadequate. It is this at which listeners are poor. If the listener indicated when he was unable to make a choice, as did the ideal listener and the talking doll, the speaker was able to modify his description and reasonably satisfactory communication was possible. Why then does the child listener not fulfil this function? It could be said that he fails to perceive the speaker's role attributes, but a more helpful way of looking at it may be to say that he fails to see he is a causal link in the communicating chain. Listeners are just as vital as speakers to communication - without both there would not be any - but young children as listeners tend to be passive. Ways were found to involve them more, and these are referred to in other sections, but it is argued that because verbal communication is a more abstract process for the listener, than the speaker, he is less successful. The speaker has the object in front of him as he describes it - reality is assisting him as he carries out his function. But the listener has to decode abstract input and relate it to reality. There are situations, of course, where there is no concrete reality at all to aid the listener, such as the stories which Piaget asked children to recount to each other, and not surprisingly these represent the most difficult tasks of all for children, even as old as 7. In line with this was the common listeners' strategy of selecting objects. in the talking doll studies, based on the

'given' attribute, and then acting as if that message was sufficient to enable them to select a block. It is argued that what the listener is doing is giving himself an active role in the task. At the time it was mentioned that the listener's strategy seemed to be to get the speaker's block to match their own. This would be described by Piaget as egocentrism, but that obscures what is seen as the critical factor in communication breakdown, since a more specific factor than egocentrism on the part of participants seems to have been isolated. (See section 4 for further discussion on this issue.)

3. A breakdown of the constituent skills involved in communication.

The rather ambitious aim of Chapter 5 was an investigation of some of the skills thought to be involved in communication, following an analysis of the previous findings. The well-known difficulty of distinguishing competence and performance was raised by this and also the problem of using language (in instructions) to investigate language use. It was considered useful to carry out these investigations within the framework of the existing research.

It is evident that perception of the features that differentiate one object from another is a necessary ability for participants in these communication tasks. As a test of this, subjects were asked to make paired comparisons of similar, but for the most part not identical, pictures. The same material was subsequently used in a communication task where the child was paired with an adult speaker providing minimal, but adequate, information. This was not primarily a follow-up of the earlier task, but it did allow one to see if the type of errors made in the first task were those that also gave rise to failure in the communication task. In the event there were relatively few errors in the ideal speaker task. The effect of the communication situation seemed to be 'to concentrate the mind wonderfully', in Johnson's phrase, but in this case the cause was not the thought of imminent death but the minimally adequate messages of the speaker. It

seems that differentiating descriptions assist the discrimination task considerably. Nevertheless when errors do occur they are of the same type that characterised the earlier study.

If we might return to that study for a moment, the indications were that discrimination of differences would not be a major cause of communication difficulty but might be critical for some subjects. Analysis of individual performances revealed some interesting strategies being followed. A hypothesis was put forward that for many children the features might be seen as having weightings, depending on their salience for individual subjects. These weightings determined the strength of the evidence that was considered in reaching a judgement. Changing features were found to carry most weight, but some were found to be 'heavier' than others. For some children the force of a distinctive colour change obscured more subtle differences of size and presence or absence of a feature. It was argued that the use of a motor device for signalling same/not-same allowed the child to indicate explicitly when he could not make up his mind about the evidence. Hence both buttons were pressed and same and not-same judgements resulted. Donaldson and Wales (1970) and Clark (1973) have discussed such issues in the acquisition of relational terms like 'same' and 'different' and it may be that the use of a non-verbal device might assist research in this area.

A variation on the above theme was the strategy adopted by at least three subjects, namely, comparing pictures independently against a standard of comparison set up by themselves, so that one of a pair might be judged same and the other not-same. Essentially these children had understood, in a slightly distorted fashion, the comparative meaning implicit in the words same and different. The acquisition of these terms is fascinating precisely because the relation between the word and the context, which, it has been argued, is critical for meaning, is such a complex one. A 'same' cannot be simply pointed to, and examples of situations which

do correspond to our understanding of these terms are many and varied.

A third incidental finding was the strategy of using the absence of a critical feature as a criterion for sameness. Teddy bears were the same because they did not have sticks (even though they might have different size hats). Again the absent feature was determined by the context as a whole. Teddies were never judged not the same because they did not have gloves, because no teddies possessed gloves! This is further support for contextual theories of meaning (e.g. Macnamara, 1972, Olson, 1970).

The finding from the second experiment in this series, that children could not conserve identity, at least when withdrawn items from series were shown not to match, represented a possible reason for the number of attributes, included in messages, not reducing as a function of the number of available alternatives. The account already offered, concerning the encoding effort involved in restricting messages to differentiating features, is generally preferred. This is not to say that an appreciation of equivalence is not involved in successful communication since such a recognition must aid the efficiency of the process. It does not seem to have been considered, however, as a variable by other workers in the area.

There is a study that has some relevance to this experiment and that is the one by Flavell et al. on role-taking reported in Chapter 1. It is not altogether clear to what extent role taking is critical in the conservation of equivalence experiment. As reported in Chapter 5, Study II, most of the children seemed to be able to make the sort of perceptual inference necessary to the understanding that the view of another may not be the same as one's own. But the sort of manipulations which went on in Study II were very much more complex than those involved in Flavell's task and had more in common with a conservation of number experiment. This was particularly because of the mismatch procedure and the presence of screens. More research is needed on this topic, particularly since a consequence of failure to recognise the constant equivalence of

speaker and listener's arrays is that the perceived alternatives which are thought to affect message construction (Olson, 1970) are not perceived.

According to Piaget the egocentric pre-school child is not able to account of another. It follows that a listener replying to a speaker, 'I don't know which one you mean - can you help me some more?' would not draw a modified or changed description from the speaker. A listener who made precisely the above request was provided to test this aspect of the egocentric hypothesis. The findings have already been reported above and compared with a study on speakers' modification behaviour by Krauss and Glucksberg. It will be recalled that nearly three-quarters of the children who gave initial inadequate descriptions were able to modify them after feedback. The quarter who were only able to respond to direct questions of the form 'Is it x or y?' are of interest since they throw light on the sort of cognitive factors underlying the inability to modify. (Details can be found in Study III, Chapter 5). The use of the term egocentrism to describe this syndrome is thus potentially counterproductive for it can serve to direct attention away from the specific factors which, in fact, make up the behaviour. Further consideration of the egocentrism issue will be found in section 4.

The main findings from the study which paired children with an ideal speaker (Study IV) were reviewed in the previous sections. The prevailing impression given and reported was the competence of the children in decoding the minimally adequate messages, checking off in a systematic manner the transmitted attributes against the array in front of them. But possibly more informative were the factors which appeared to give rise to errors, since these might add more to a long-term aim of understanding communication development. These factors included premature selection of an item before the message was complete or had been fully processed; failure to realise the dependent relationship between speaker's message and listener's choice which, it was hypothesised, accounted for perseveration; difficulty in

perceiving perceptual differences and inability to cope with the abstract nature of the instructions. These factors have been discussed elsewhere, but an additional point of interest is attached to the last finding.

The importance of action for the listener was emphasised in a previous section. Piaget has distinguished between the acted and verbal case and attempts were made to act in accordance with this distinction. Examples include the use of concrete material, encouraging finger pointing at the selected card and use of non-verbal signalling devices. In Study IV it was found that some children were helped when the speaker indicated selection of a card by holding it up, blank side to the listener, and said 'I've picked this one - I'll tell you about it - see if you can find the same one among your pictures.' The success of this procedure indicates there is still room for a greater degree of action and concreteness in the administration of these tasks. (Sheldon White, 1969, provides a good discussion of this issue).

4. The nature of egocentrism.

Throughout this series of studies, findings opposing the idea that the young child is like Humpty Dumpty, taking no account of others in his verbal behaviour, have been reported. It has been made clear that the egocentric hypothesis must be rejected and, since the issue has been discussed at length already (Chapters 5, 6, and 7), some general observations will be offered in conclusion.

Some of the writings on egocentrism (e.g. Flavell et al., 1968) suggest that the young child is not able to adapt to the needs of others; this is reflected by an inability to modify behaviour when it would be appropriate to do so. But it may be that the degree of inflexibility that this suggests is suffered by the young child is exaggerated. Is there a distinction between the child who tries to persuade his mother to let him stay up later than usual and the speaker who wants to get the listener to select a particular object? There are of course many differences, the

most important of which is the dominating measure of self interest in the former behaviour. But there also seems to be a substantial common element. The child may use very subtle ploys to influence his mother, which will require being very alert to the smallest changes in her behaviour, including such communication factors as tone of voice, facial expression as well as speech content.

Bell (1968) has indicated that the developmental history of this sort of behaviour starts very early. He has looked at the use the infant makes of his limited repertoire, crying, smiling, etc., to affect his mother's behaviour. Those taking an ethological approach (e.g. Richards, 1974, and in press) have shown what a complex two-way process is the interaction between mother and child, each influencing the other. So communication begins at an early age. Initially, 'purposive' communication is aimed at alleviating physical needs - hunger, warmth, elimination, etc. Later it comes to take on more sophisticated targets such as the preference for one food rather than another. Very often the method of achieving these goals is to use a stereotype - a motor routine - that has been found to work in the past, varying from a wheedling tone, or expression, to a temper tantrum. When such means fail some variation may be introduced, and when language is acquired the child's armoury is much strengthened. As long as the child is able to try out a variation, can it be argued that he is limited by egocentrism?

It may be protested that such behaviour, motivated entirely by self-interest, is precisely what egocentrism refers to. Yet even the child 'trying to get his own way' discovers that such a goal is facilitated by taking account of the other's attributes - by using one strategy rather than another. This makes one question the crippling effect that is implied by Piaget's use of the term (Piaget and Inhelder, 1969). In trying to relate their experimental findings to 'real life' situations Flavell et al. (1968) say that the young child manages because he will "set his enter-

prises in rough correspondence with his capabilities, to make what he tries to do accord reasonably well with what he can do." And "the communicative tasks he poses for himself are typically much simpler than those which his elders undertake." (p. 216). This is undoubtedly true, but the critical question is, when does a child start to modify his behaviour in order to take account of another's perspective? Once there is evidence of this sort of response, then egocentrism is breaking down. For, it is argued, egocentrism can probably never be viewed as an absolute restriction on human development. Statements which suggest that egocentrism characterises humans at a certain age are therefore misleading. Egocentrism is more likely something we all possess permanently, to varying degrees and depending on situations.¹ The reason it has taken on importance in the three to six year age range is probably that it is particularly easy to demonstrate at that age. Elkind (1967) has indicated the influence of egocentrism in adolescence and Loft (1972) has suggested that it is manifested throughout the life span and increases in later life.

The question which remains is do we need the term egocentrism? The usefulness of any hypothetical construct is not only its explanatory power but its faculty in bringing together pieces of behaviour which at first seem unrelated. It has already been argued that the explanatory power of the concept is limited. It is too global and diffuse an idea to be of much

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1. Observing the child in these communication tasks it has sometimes seemed as if the cognitive apparatus has been too fully engaged handling an encoding problem to have any spare capacity for considering how another may view the same situation. It is like an inability to detach oneself - an attentional problem in other words. If our own minds are pre-occupied with something, it becomes difficult to take account of other things, persons, ideas etc. Piaget is probably partly right when he says that social interaction affects ^{the} behaviour, since one learns there are sanctions to be suffered for not taking account of others.

service at our present state of knowledge. Indeed, until more research is conducted we will not even be in a position to make use of the term. It is an explanatory concept with very few hard facts to explain. For the time being at least the aims should be more modest, namely, to reveal the specific perceptual (which includes contextual, extra-linguistic factors), cognitive, (which includes rule-following behaviour), and language influences at work in the various social situations in which a young child finds himself.

As an umbrella term bringing together pieces of previously unrelated theory and findings, egocentrism has served a useful purpose. Some social and personality psychologists have been reinterpreting conformity behaviour in this light (e.g. Feffer, 1970, Weinheimer, 1972) and Looft, (1972), as well as seeing egocentrism as a life-span phenomenon, has also indicated that some of the psychoanalytic concepts can be viewed within the same framework. While applauding attempts to rationalize psychology a danger follows from what has been said previously, that is, that egocentrism has not, as yet, the status of an explanatory concept in developmental psychology. Nevertheless, since the study of human behaviour has always marched on many fronts, some of which, logically, do not belong in the same army, more might be lost than gained by totally dispensing with the term at this stage.

5. The role of extra-linguistic factors.

The extra-linguistic factors which will be discussed are those which have particularly influenced communication behaviour in the tasks used. We will be mainly concerned, therefore, with the way properties of the material used have affected attention and speech production and comprehension.

It is well known that, not only are there certain attentional strategies used by children, but also that some properties of objects and situations are more salient to children than others, and that both affect the child's transactions with the environment. These phenomena have been discussed by various writers operating in slightly different theoretical frameworks.

Piaget, for instance, refers to centration, the gestaltists to field effects, Witkin to field dependency, while White (1969) and Maccoby (1969) have preferred an attentional approach. A number of postulates have emerged, such as 'younger children focus on whatever level of the stimulus is most strongly organised' (paraphrasing Maccoby), and "the amount of irrelevant information that can be tolerated without affecting the response increases (with age)" (Wohlwill, 1962). In discussing stimulus selection, Maccoby says that it is the effect of unwanted material on perception of wanted material that is the heart of the problem, and, if not the heart of the problem, this would also seem to be an important factor in successful communication.

It was seen that certain features of material did tend to 'capture' the attention of children - the coats of the teddy bears, the smoke on the houses, the cross and the hole on the blocks - and in many cases this was productive, for such features were critical for discriminating the items. But there were cases where they were too powerful, so that salient differences would be reported, like coat colour, but more subtle ones like the presence of a stick would be missed. When it came to attributes which could only be perceived by comparing one block with another, such as size, and which required the child to stand back, as it were, the likelihood of it capturing attention and so being reported was much less. When the material could only be usefully discriminated by employing abstract terms which referred to spatial relations, the difficulties were considerable. Some children consistently used very detailed descriptions which have been called analytic. They were quite unhelpful since they corresponded to no level of perception that was recognisable by listeners. It is difficult to know what level of the stimulus was most highly organised for these children. They appeared to represent an extreme degree of field dependence.

The particular concern in this research has been where contextual factors have specifically affected language production or comprehension.

Clark (1973) and Macnamara (1972) have pointed out how powerful such influences are for young children and some instances emerged in these studies. Most attention has been paid to the effect material properties have on descriptions, in these studies, that is, on the behaviour of the speaker. An example was the division found between colour conscious and component conscious children in the houses experiment. But there are good reasons to think that such effects play an even greater part for the child interpreting the response - the listener. The young listener in these communication tasks was often unclear about the message he heard. When in doubt the sensible course is to use the concrete situation to help in giving meaning to the utterance. But which will be more influential, the situation or the verbal message? There is no straightforward answer to this. It will depend on the age of the child, the content of the message, the clarity of the message, the 'power' of the situation for that child, and a number of other factors. But since the young child, as we have seen, does not tend to seek an expansion of an utterance, except in special situations like that with the talking doll, the relation between the utterance and the situation obtaining will often be crucial.

A message like 'It's one with a red cross on it', usually caused a child to select an object answering to this description, but since such a message was insufficient to determine the chosen item from others like it an error could easily result. But, leaving aside inappropriate descriptions, there is also the possibility, for the young child especially, that the attention capturing properties of the material will be so great that the listener's choice will be determined by that, rather than by the utterance. This problem will exist for older children, as well, when the language is more abstract. Some examples of this were given in the concluding section to Chapter 6. What seems to happen is that when a child is uncertain about an utterance, he reformulates the message in a way he can understand, using the properties of the situation to aid him. This is what gives

rise to the results of Clark (1973), when young children were using non-linguistic strategies and/or partial semantic knowledge to interpret prepositions like 'in', 'on', and 'under'.

Although total reliance on context, to the exclusion of language, is usually unadaptive, a consideration of context is, of course, essential for both speaker and listener. It is because he is tied too closely to the context that the child cannot always make use of it in the manner specified by Olson. Nevertheless we have seen that pre-school children frequently make use of context to assist them in communication. A nice example was seen in the first pilot study, when the description 'buffalo' applied to a crocodile was perfectly adequate to discriminate it for the listener, because among the perceived alternatives there was nothing that resembled a buffalo more than the crocodile. The relation between the effect of context on language in Olson's sense, and the effect of the saliency of features on attention and therefore language is not clear. Presumably the effects of saliency are more powerful for the younger child, but Donaldson and McGarrigle (in press) have argued that context, in the form of 'local rules' may play a part up to middle childhood. As distinct from this effect, which causes children to structure or interpret language in a certain way, Olson's point about the context as a whole affecting the construction of messages is a feature which affects all communication.

6. A technique for investigating thinking in the young child.

Russian psychologists in particular (e.g. Vygotsky, 1962, Luria, 1959) have argued that language increasingly plays a directive role in thinking. As pointed out in the Introduction, it appears initially (Vygotsky, 1962) as egocentric speech which is the overt precursor of inner speech which, it is argued, becomes a powerful mediator of symbolic processes. If egocentric speech is a feature of young children's language, it was thought it might appear in these tasks. Instances which might qualify as egocentric speech were relatively few, however. This may have been because the tasks did

not encourage such behaviour, and in this context it is of interest that the occasion on which Janet voiced her 'cognitive rule' (Pilot Study II) - 'colour first' - while describing a picture of a car, she had been interrupted by her partner just as she had been about to begin her message. Vygotsky has suggested that task interruption is a circumstance which precipitates egocentric speech. On the other occasions on which egocentric speech seemed to be present, the behaviour was as Vygotsky has described it (see p. 14 of this volume). The child seemed to be using language to organise his perception of the object in question.

Apart from the scattered references to egocentric speech to be found in this work, a final study sought to use the communication situation to gain some insight into conceptual thinking. The findings have been presented in Chapter 7. In a sentence they showed that as a technique it was useful because it showed what aspects of the problem the child considered important, but as a method of instruction its success was governed to some extent by the materials used. When the materials lent themselves to the task, as in the first seriation experiment - stacking blocks on a peg, the level of success was high. In the second experiment material properties did not assist ordering behaviour and difficulties were presented by speakers having to specify spatial position, or direction of placing, as well as temporal order.

Olson (1970, 1972) has pointed out that in the communication sense language is not an aid to the speaker, but to the listener. Its consequence is to alter the way in which the listener perceives that context. In extreme cases he might even see a crocodile as a buffalo. It is only later, when the child is able to use sentences as propositions, that language can be said to restructure the perceptions of the speaker himself (Olson, 1972, p. 162).

Since it is unlikely that these children would be using language in the propositional sense, the communication situation as a method for

instructing others is an interesting possibility. Since it can work with children between three and five, there is no reason why it should not be a useful educational facility at a later age. This is not to suggest that intellectual abilities are necessarily improved using such a technique. Its application may be better directed towards personality and social behaviour in which a child might be encouraged to become, say, less withdrawn, less dominating, more co-operative or whatever.

The illustration given in Appendix G shows that the listener for the most part has difficulty in making sense of the communication. This is partly because he cannot subordinate his desires to those of his instructor, but also because the task is very demanding for someone not yet four years old. The significant point is that a degree of success is still achieved. Some suggestions for future studies in this area.

1. An obvious requirement is a follow-up of the basic type of communication task (Chapter 4) with a large sample.
2. A more active procedure might be employed, particularly with a view to engaging the active involvement of the listener. If, for instance, the material used was blocks with pictures on, the reverse side might be in view of the listener. This would mean that when the speaker selected a block, by physically pulling one forward, the listener would realise that a real event - the description of a concrete object - was taking place.
3. The verbal nature of communication might be encouraged by the use of telephones. It would not be necessary for the children actually to communicate by real telephones but to have toy ones in front of them which they would use during the game. Observation of children in a nursery play situation indicates that having pretend telephone conversations is a popular activity.
4. It was proposed that a cause of ^{poor} communication was the participants' failure to appreciate the dependent relationship involved. This seemed to be particularly true of listeners. In the tasks used thus far, a

recognition of the equivalence of arrays over time seems necessary for such a realisation of causal dependence. The proposals in (2) and (3) above may go some way to achieve this recognition. But it may be that the dependent relationship can be built into the task itself. The goal needs to be made explicit for the participants and it must also be evident that the goal can be achieved only if the children co-operate. The task would be such that child A and child B each have a piece of information which together would represent a solution. A possible illustration would be if a large picture depicting a sequential type of event was cut in half so that each child had half the 'solution' - the goal could only be reached if they communicated. A third party might be used who would provide feedback, possibly illustrating the story as it was recounted, so that they could at all times see the goal to which they were working. If the goal was manifestly a rewarding one it might further encourage the children. Such a task would not have a speaker and listener in the sense of other tasks described here.

5. The talking doll was seen as a particularly effective partner and it may be productive to use this situation in a more flexible manner, e.g. in telling stories - but more simplified than the ones used by Piaget (1926). The talking doll might also represent a valuable remedial instrument for children with language difficulties. Unfortunately the technique as presently devised is not portable and somewhat expensive.

6. The indices of communication used were considered adequate for the tasks employed. But other approaches could be used, for example modifications of content analyses used by Jarvis and Fry with older children (see Flavell et al., 1968).

7. Communication need not be restricted to two persons. It would be of interest to compare the effectiveness of a speaker with more than one listener. Would it lead to more feedback and therefore be more productive, or would unadaptive chaos result? With older children communication networks on the lines developed by Bales (1950) might be used.

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APPENDIX A Trial by trial performances for children as speakers in the Ideal Listener Task, Chapter 5 - Study III. Data include number of descriptions per trial and classification of messages

	Alan	Lee	Scott	Jamie	Gregor	Elizabeth	Nicholas	Karen	David	Sally	Clare	Paul	Anna	Christine
	4 8 N*T*	4 7 N T	4 4 N T	4 1 N T	4 2 N T	3 11 N T	3 10 N T	3 8 N T	3 8 N T	3 6 N T	3 6 N T	3 5 N T	3 4 N T	3 4 N T
Block														
Trial														
I														
1	4 CI	2 CI	5 CI	8 CI	5 C	2 CI	2 CI	2 C	3 CI	2 CI	2 C	5 C	2 C	3 CI
2	2 CI	1 AI	4 CI	4 CI	3 C	3 CI	2 CI	1 AI	2 CI	1 AI	1 A	6 CI	1 A	3 CI
3	1 AI	1 AI	4 CI	2 CI	2 C	1 AI	4 CI	2 CI	2 CI	1 AI	3 CI	2 CI	9 X	1 AI
4	2 CI	1 AI	1 A	2 CI	1 AI	2 CI	2 CI	1 AI	2 CI	1 AI	4 CI	2 C	3 C	1 AI.
5	1 AI	1 AI	2 CI	1 A	1 AI	1 A	2 CI	1 AI	4 CI	1 AI	1 A	1 AI	1 AI	1 AI
6													3 CI	
II														
1	2 CI	1 A	2 C	4 X	6 CI	4 C	2 CI	3 CI	5 C	2 CI	1 A	1 A		2 CI
2	1 A	1 AI	3 CI	4 CI	5 C	1 AI	2 CI	1 AI	2 CI	1 AI	1 AI	1 AI		3 CI
3	1 AI	1 A	1 AI	1 AI	2 CI	1 AI	1 AI	5 CI	3 CI	2 CI	2 CI	6 CI		4 CI
4	1 A	2 CI	1 AI	1 A	4 X	1 AI	2 CI	1 AI	1 AI	1 AI	1 AI	1 AI		1 A
5	1 AI	1 AI	2 CI	3 CI	1 A	1 AI	1 AI	1 AI	2 CI	2 CI	1 AI	3 CI		1 AI
6				1 AI	1 AI									

*N = No. of messages transmitted

*T = Type of final message

i.e. A = Adequate (no redundancy)

C = Combined descriptions adequate

I = Descriptions including irrelevant (redundant) attributes

X = Incorrect

APPENDIX B

Shorthand descriptions of the way in which children as speakers respond to feedback from an ideal listener (see Chapter 5, Study III)

	Block 1					Block 2				
	1	2	3	4	5	1	2	3	4	5
1. Alan	R,R,Q	R,Q	-	M	-	-	-	-	-	-
2. Lee	ME	-	-	-	-	-	-	-	ME	-
3. Scott	ME,R,R,Q	Q,R,ME	ME,ME	-	ME	M	R,ME	-	-	ME
4. Jamie	R,Q	R,ME,ME	ME	M	-	ME,R,M	Q	-	-	Q
5. Gregor	R,M,R,ME	M,ME	ME	-	-	ME,R,ME	M,M,Q,Q	-	M,R	-
6. Elizabeth	ME	R,ME	-	R,ME	-	R,R,ME	-	-	-	-
7. Nicholas	ME	ME	ME,R,ME	-	-	ME	ME	-	ME	M
8. Karen	ME	-	ME	-	-	R,Q	-	R,R,R,Q	-	-
9. David	Q,Q	Q	M	M	ME,R,Q	ME,R,R,Q	ME	M,M	-	ME
10. Sally	ME	-	-	-	-	ME	-	ME	-	ME
11. Clare	ME	-	ME,ME	R,ME,ME	-	-	-	ME	-	-
12. Paul	ME,R,R,Q	R,R,Q	Q	Q	-	-	-	Q	-	ME
13. Anna	ME	-	M,M,Q,R,R, Q,Q	ME,Q	-	-	-	-	-	-
14. Christine	R,ME	R,ME	-	-	-	ME	M,ME	M,R,ME	-	-

- = First description adequate, no feedback necessary

M = Modified response

R = Repetition (i.e. ignoring feedback)

ME = Modified response following E's feedback

Q = Answering E's question

APPENDIX C

Detailed error distribution for children as listeners to an ideal speaker

SUBJECT:	Alan	Lee	Dale	Linda	Scott	Jamie	Gregor	Margaret	Elizabeth	Nicholas	Karen	David	Sally	Clare	Paul	Anna	Christine
AGE:	4 8	4 7	4 7	4 6	4 4	4 1	4 2	4 0	3 11	3 10	3 8	3 8	3 6	3 6	3 5	3 4	3 4
	S*L	S L	S L	S L	S L	S L	S L	S L	S L	S L	S L	S L	S L	S L	S L	S L	S L

TRIAL

1	B B	A A	E E	B C	D D	A A	F C	A A	B C	D E	C C	B A	F F	D D	D E	D D	B E
2	E E	C C	F F	A A	E B	F F	F F	D E	F F	E E	F F	A A	A A	E F	A A	F C	F F
3	C C	D D	D D	B B	E B	E E	E E	E E	B E	B A	A A	B B	D D	E E	D D	B A	B B
4	A D	F F	A A	F F	B B	B E	A A	C C	B A	F F	B B	F F	B B	B B	B B	B A	B B
5	D D	F F	C C	D D	E E	D D	D D	B B	B B	B B	D D	C C	C C	C C	E E	B A	E E
6	F F	E E	B B	C C	A A	E E	B B	F F	E E	C C	E E	D D	E E	A A	F C	B A	C C
	A A	B B	B B	E E	C C	C C	C C	F F	D D	A A	E E	E E	E E	F F	C C	A A	A D
1	F C	D E	F E	C C	A B	C C	E E	C C	B E	F C	F C	F B	C C	D A	B B	E E	B B
2	C C	E E	F F	A A	B C	E B	D D	B B	E E	C C	C C	B A	E E	A A	B A	C C	F F
3	A A	B B	B B	D E	D D	E B	C C	E D	B A	B A	A A	A A	B B	E E	A A	F F	C C
4	B B	C C	F F	E E	B B	D D	A A	E E	E E	A A	D D	D D	A A	C C	E E	C C	E E
5	D D	A A	F F	B B	E E	F F	F F	D D	B B	D D	B B	C C	A A	F F	F F	B B	D D
6	E E	F F	D D	F F	F F	A A	B B	A A	A A	B B	E E	E E	D D	B B	D D	A A	A A

Letters represent picture choice. For key see Chapter 5, Study IV, page (Wrong choices underlined)

*S = Speaker (Experimenter)
L = Listener (Child)

APPENDIX D Child (Speaker) with Doll

SUBJECTS:
AGE:

Alan	Lee	Linda	Scott	Gregor	Jamie	Elizabeth	Nicholas	David	Sally	Clare	Paul	Anna	Christine
5 1	5 0	4 11	4 9	4 7	4 6	4 4	4 3	4 1	3 11	3 10	3 10	3 10	3 9

TRIAL

1	3 NI2	2 C	4 CI	2 N1	5 N1	6 NI1	2 N1	3 C	3 NI2	1 N1	2 N1	11 NI1	7 N1	3 NI1
2	3 NI2	2 C	5 NI1	2 N1	3 C	4 NI1	1 N1	4 C	4 CI	1 AI	1 A	6 NI1	7 CI	1 N1
3	4 NI2	1 AI	6 CI	2 N1	2 NI1	3 CI	2 NI1	2 C	2 CI	1 NI1	1 NI1	7 NI1	2 AI	3 NI1
4	3 NI1	2 C	1 AI	2 N1	1 N1	1 NI2	2 NI1	1 AI	2 NI1	1 NI1	1 NI1	2 NI1	2 CI	2 AI
TOTAL NO.														
13	7	16	8	11	14	7	10	11	4	5	26	18	9	
DESCRIPTIONS:														

TRIAL ATTRIBUTE
OMITTED

OMISSIONS

1	B(BXH) X	(BXH)	(LXH)	B(BXH)	(BXH)	(BXH)	(LXH)	B(BXH)	(LXH)	L(LXH)	L(LXH)	(LXH)	B(BXH)
2	B(BXH) X	(LXH)	(LXH)	B(BXH)	(BXH)	(LXH)	(BXH)	H	H	(LXH)	(LXH)	(BXH)	B(BXH)
3	B(BXH) H	(LXH)	(BXH)	B(BXH)	(BXH)	(BXH)	(BXH)	H	H	(LXH)	(LXH)	(BXH)	L(LXH)
4	B(BXH) H	(LXH)	(LXH)	B(BXH)	(LXH)	(LXH)	(LXH)	B(BXH)	B(BXH)	L(LXH)	(LXH)	(LXH)	(LXH)

(Top) Number of descriptions per trial and category of final message for each subject.

(Below) Record of attributes omitted for each subject with block choices for each trial given in parenthesis.

APPENDIX E

Child as Listener to Doll as Speaker (BLOCKS). Record of blocks selected by speaker and listeners and attributes derived. 'Adequate' trials are underlined

		BLOCK SELECTED				ATTRIBUTE FOR WHICH INFORMATION SOUGHT			
		1		2		3		4	
		D	S	D	S	D	S	D	S
Alan	BXH	BXH	BXH	LXH	BXH	LXH	BXH	LXH	BXH
Lee	BXH	BXH	BXH	LXH	BXH	LXH	BXH	LXH	BXH
Dale	BXH	BXH	LXH	LXH	BXH	LXH	BXH	LXH	BXH
Linda	BXH	BXH	BXH	LXH	BXH	LXH	BXH	LXH	BXH
Scott	BXH	BXH	LXH	LXH	BXH	LXH	BXH	LXH	BXH
Gregor	BXH	BXH	LXH	LXH	BXH	LXH	BXH	LXH	BXH
Jamie	BXH	BXH	BXH	LXH	BXH	LXH	BXH	LXH	BXH
Elizabeth	BXH	BXH	BXH	LXH	BXH	LXH	BXH	LXH	BXH
Nicholas	BXH	BXH	BXH	LXH	BXH	LXH	BXH	LXH	BXH
Karen	BXH	BXH	BXH	LXH	BXH	LXH	BXH	LXH	BXH
David	BXH	BXH	BXH	LXH	BXH	LXH	BXH	LXH	BXH
Sally	BXH	BXH	BXH	LXH	BXH	LXH	BXH	LXH	BXH
Clare	BXH	BXH	BXH	LXH	BXH	LXH	BXH	LXH	BXH
Paul	BXH	BXH	BXH	LXH	BXH	LXH	BXH	LXH	BXH
Anna	BXH	BXH	BXH	LXH	BXH	LXH	BXH	LXH	BXH
Christine	BXH	BXH	BXH	LXH	BXH	LXH	BXH	LXH	BXH

1 Reason why doll's choice is not always the standard one is that when child chooses before adequate description obtained but chooses selected block, doll changes original selection to give deliberate mismatch.

* Not a direct question about a particular attribute, e.g. 'What's on it?'

APPENDIX F

<u>SPEAKER (LEE (E))</u>				<u>LISTENER (PAUL (N))</u>			
<u>Trial</u>	<u>Unit</u>	<u>Action</u>	<u>Running Sequence</u> <u>(C T H F CP CH)</u> <u>correct order</u>	<u>Action</u>	<u>Running Sequence</u>		
I	1	C		-			
	2	T	C T	c			
	3	T*	C T	T	T C		
	4	H	C T H	h F*	H T C		
	5	F	C T H F	H*	H T C		
	6	CP	C T H F CP	CP	H T C CP		
	7	CH	C T H F CP CH	CH	H T C CP CH		
	8	-	C T H F CP CH	F	H T C CP CH F		
II	1	C		c			
	2	T	C T	c			
	3			CP			
III	1	C		c			
	2	T	C T	t	C T		
	3	H	C T H	h	C T H		
	4	F	C T H F	-			
	5	F*		F	C T H F		
	6	CP	C T H F CP	cp	C T H F CP		
	7	CH	C T H F CP CH	ch	C T H F CP CH		
<u>Paul (N)</u>				<u>Lee (E)</u>			
IV	1	C*					
	2	c		c			
	3	T	C T	t	C T		
	4	CH	C T CH	-			
	5	F	C T CH F	h	C T H		
	6	<u>Fh</u>	C T CH H	-	C T H		
	7	<u>Hh</u>	H C T CH	-	C T H		
	8	H*		-			

<u>Trial</u>	<u>Unit</u>	<u>Action</u>	<u>Running Sequence</u>	<u>Action</u>	<u>Running Sequence</u>
V	1	c		-	
	2	C*		C	
	3	T	C T	t	C T
	4	CH	C T CH	h	C T H
	5	CP	C T CH CP	f	C T H F
	6	<u>CP</u>		cp	ch C T H F CP CH
	7	-		cp	
			<u>Lee</u>		<u>Paul</u>
VI	1	C		-	
	2	C*		-	
	3	C*		c	
	4	T	C T	t	C T
	5	H	C T H	H*	C T
	6	F CP CH	C T H F CP CH	-	
VII	1	C		C	
	2	T	C T	T	C T
	3	H	C T H	h	C T H
	4	F	C T H F	f	C T H F
	5	CP	C T H F CP	cp	C T H F CP
	6	CH	C T H F CP CH	ch	C T H F CP CH
<u>Reverse Order</u>					
VIII	1	CH		CH	
	2	CP	CH CP	cp	CH CP
	3	F	CH CP F	f	CH CP F
	4	H	CH CP F H	h	CH CP F H
	5	T	CH CP F H T	t	CH CP F H T
	6	C	CH CP F H T C	c	CH CP F H T C

KEY

Unit = piece of behaviour by either or both speakers which results in a transformation of array e.g. adding of stick, removal of stick, transposing of stick, etc.

Cat (C), Train (T), House (H), Fish (F), Cup (CP), Chair (CH)

sticks with abbreviations in order of descending height.

C = Subject articulates and erects stick (cat)

c = Subject erects stick, no articulation

C* = Subject articulates stick, not erected or already erected (repetition)

(C) = Speaker erects stick in response to listener's message

- = No material action by subject.

1, 2, 3, etc. = Figures represent order in which units carried out.

APPENDIX G

Performance record of one pair in seriation task, Experiment Two,
transcribed from videotape.

Communication/Seriation - 2(sticks)

Lee (Experienced) - Paul (Naive)
(27.6.72)

(Experienced subject enters first and is reminded of material which she
has seen during a preliminary session the previous day)

E: Lets mix all (yours) up because I don't want him to see how its done.

(E randomly mixes her sticks).

L: Will you do it how Paul's got his? [asking if her array should correspond
to Paul's].

E: It doesn't matter.

L: My trouser suit's wet. Playing in the water ...

(Has a good look round the room while E is getting P. Tries to peep
through window of cubicle).

Paul enters

[]

E: You've got to stand the sticks up in the way Lee tells you.

TRIAL 1

L: You put the cat up.

P: (sitting doing nothing, looks across at Lee) Yes.

E: You do the same thing Paul. Do what Lee tells you.

L: Er .. train (stands it in line)

P: (Still getting cat up - at first on top of another stick that is
horizontal)

E: (To Paul) Did you hear Lee?

P: Yeah (not doing anything)

E: What did she say next?

L: Train

P: Train (puts train on left of cat)

L: Then the house (puts it in line).

P: (picks up house and puts it beside train) I haven't got my fish up.

L: Then the fish (puts it in line)

P: The house (referring to that which he has just completed).

L: Cup (putting it in line).

P: Cup (picks it up and puts it in line having missed out fish)

L: And then the chair (finishes serializing)

P: Chair (stands it in line. Waits for another message) Where's that, there?

E: Have you got all yours up, Paul?

P: I've not got the fish up (picks it up and puts it on end).

L: (chuckles)

E: Can you help him, Lee?

L: The cat, the train, then the house, then the fish, then the cup, then the chair.

P: (hand on fish) Mine are all up.

E: (noticing Paul has his pictures obscured from himself, turns them round. Paul still fingers fish and at one point seems to think about putting it somewhere else).

P: I can build a castle.

(E removes screens)

E: Are they just the same?

L: They're just about, but they aren't quite.

TRIAL 2

E: Don't go too fast Lee, because Paul hasn't done this before.

L: I done it yesterday.

E: Right Paul - listen carefully to Lee.

L: You put the cat up (stands it up and looks across to Paul, waiting).

P: (Stands cat up)

L: And then the train (puts train up).

P: Well, I want (?) to put that (standing cat up)

E: Are you listening to Lee?

P: Well I'm goin' (don't think?) put the cup up.

E: No it wasn't the cup. Lets start again []

TRIAL 3

E: You've got to listen to Lee and do just what she tells you.

L: You put the cat up (standing it up)

P: (stands his cat up in the middle of the sticks).

E: Put it over there so you've got more room.

L: Then the train (having put it up. Looks across at Paul to see if he's ready)

P: (puts train up)

L: Then the house (puts it in line)

P: (puts it in line)

L: (patiently waiting for P to finish) Then the fish (pronounces it fush. Puts it in line)

P: What? (hasn't understood word)

L: Fish

P: Fish (puts it in line)

L: Then the cup (puts it in line)

P: (puts cup in line)

L: Then chair (both add chair and finish seriating)

(E removes screens)

(both correct)

TRIAL 4

P: Put the cat up (no movement himself)

E: You can do it as well

P: (stands cat up as does Lee) Put the train up (puts it in line)

L: (has train ready in hand. Smiles slightly when P gives instruction and puts the train up

P: Put the chair up (now apparent that he is erecting them in the order

they are on the table)

L: (ignores his message and picks up house)

P: Put the fish up (stands it in line)

L: (after hesitating, decides to put house next to train)

P: Put the ... oh, getting mixed up (appears to notice that the order is incorrect when he picks up the house. Removes fish and stands house in front of chair)

E: Tell Lee if you change it

P: (puts house right at the other end of the line next to cat)

L: (chuckles, noticing his strategy - or perhaps the look of concern on his face)

P: House up

E: Where are you putting the house? - tell Lee

L: I've got my ----- (?) I've only got three down.

P: (looking confused - a stick in each hand - knocks over one of the line)

E: Do you want to start again, Paul. We'll start again Lee.

TRIAL 5

L: ----- (?) from the wee one to the big one?

E: No, we'll do that afterwards

P: (puts cat up)

E: Tell Lee as you do it

P: Put the cat up --- (?)

L: (puts cat up)

P: Put the train up (stands it next to cat)

L: (puts train in line)

P: Put the ... (picks up chair)

L: (already has house in hand and stands it next to train)

P: ... chair up (stands it next to train) Put the cup up (puts it next to chair)

L: (chuckles and looks at E as if the two of them recognise Paul's inadequacies) I'm putting it right (puts fish in line and carries on adding the remainder of the sticks and moves them all up right beside the screen.)

P: Wait (picks up cup and hesitates with cup in hand Takes it to other end of line, then brings it back to stand beside chair) Wait ... wait Lee (momentarily puts it on top of chair - trying to arrive at correct height?)

L: Hmm (laughs) Done it already. Hm. Done it already.

E: Lets see if Paul can tell you how to do it as well

P: (still undecided what to do with cup. Eventually discards it and picks up chair)

L: I've done it already (picks up all blocks, i.e. moves them back from against screen)

P: (this time Lee's words penetrate and he looks up in surprise and dismay??)

E: Well, you finish yours Paul. Carry on telling us

L: See what I've done.

P: You put the chair up (some way left of train) You put the cup up (between chair and train and then moves chair closer to the others)

L: I got them up, though (?)

P: (talking to himself and pushing sticks together) Got the chair up Put the fish up (looks across at Lee. Appears slightly disconcerted, perhaps because she doesn't appear to be doing anything except grin at him. Puts fish next to chair, then takes it away and tries house instead. Doesn't like house there and puts it on top of train)

L: You don't load them on top of each other

P: (puts house to end of line again, next to chair)

E: See if you can help Paul, Lee - you tell him if he's got them right

L: How can I see with the screen up? /Good question!7

E: Well you can ask him if he's got the same as you

P: (still struggling away - holds up house and fish) What about these two? (can't fit them into the pattern)

E: (to L) Tell him how you've got yours

L: I've got the cat, the train, the house, the fish, the cup and the chair (said quickly)

E: Not too fast, because Paul wants to get it right

TRIAL 6

L: The cat ...

P: I've got these sort (passing hand over his blocks)

L: (repeating louder) The cat ...

E: You see if you can get the same as Lee, Paul.

L: The cat, right?

P: (puts his hand on cat)

L: Then the train

P: (Points at his train)

L: Then the house

P: Yeah ... (touches cup) The house isn't up (picks up house from table)

E: Listen to Lee, do what she says

L: Well, its the house, then the fish, then the cup, then the chair

P: (looks puzzled, playing around with house and fish. Turns to E) I heard her but ...

E: Can you get them in then?

P: (proceeds to try and fit house and fish with no great success)

L: Do you know what the people have been doing at our stairs?

E: No

L: They've been painting and they're taking the toockies (?) away

E: Oh

L: (says something indistinct - may have been referring to P's lack of success)

P: (still struggling) I'm getting them wrong

E: Perhaps Lee will tell you once again

[]

TRIAL 7

L: Now its the cat

P: (cat still standing) The cat's up

L: And then the train

P: (searches for train, twice picking up small and incorrect sticks. The train picture is not facing up and E turns it over) There's the train (puts it next to cat)

L: Then the house

P: (puts house in line)

L: Then the fish

P: (correctly places fish)

L: Then the cup (Lee very patient, going slowly)

P: (puts cup in line)

L: Then the chair

P: (puts chair up - takes a long time to get sticks standing to his satisfaction)

(E removes screens)

E: Are they the same?

L: Yes

E: Yes, they are. Paul's goes round the corner a bit, doesn't it?

L: Mine goes straight.

E: Well, we'll do it once more

L: Upside down (referring to wee to big, with blocks, where in a sense they were placed upside down from the original order)

(E gives instructions for reverse order)

TRIAL 8

L: You put the wee one up

P: The chair (Lee echoes his words. Both stand chair up)

L: And then the cup (puts it beside chair)

P: (finds cup and stands it up where it is, a long way from chair)

E: We're going to build it out again Paul. Put the cup up properly

(P moves it next to chair)

L: Then the fish (given plenty of time to decide on next choice while Paul is getting sorted out)

P: (picks up fish and first goes to put it beside chair, and then pushes away the other sticks to make room beside cup)

L: He's getting mixed up 'cos I put the cat first before, eh?

E: No, Paul's doing very well, I think

L: And then the house (both stand it in line) Now the train (stands it in line)

P: (puts train in line)

L: Have you got the train up?

P: I've put it up

L: And the cat (completes line)

P: (Adds cat to line)

Both correct. Lee (right to left) Paul (left to right)

(E removes screens)

E: Yes, they're the same. That's very good, Paul.

P: (looks at E and smiles)

L: I've done that before, yesterday

E: Yes but Paul hadn't. He did very well, didn't he

L: Aha

P: (as he's leaving) Is Chu-Chu there, (pointing at cubicle)